Long telephotos

A long telephoto lens is an invaluable tool for creative photography, whether you want to create unusual juxtapositions, or simply to magnify a distant subject to make it larger in the final photograph


Vautier/de Nanxe

Lenses of different focal lengths each bring their own visual characteristics to a photograph. Simply fitting a particular type of lens to your camera makes you think a certain way and look specifically for subjects which suit the equipment you have at hand. Telephoto lenses in particular have this effect—when you look at your surroundings through a telephoto, certain subjects present themselves more readily than others—a row of telegraph poles that can be compressed together, a patterned field that can be isolated from a wide vista or a solitary figure walking along an empty city street.

The characteristics of longer telephoto lenses—compressed perspective, shallow depth and a narrow field of view—become more distinctive with lenses longer than around 200 mm. Lenses of this group often allow you to create pictures out of the most inauspicious surroundings.

Most people fit a long telephoto lens for its most basic purpose—to magnify the subject so that it appears larger in the frame. As such it becomes a basic tool for candids, sports, wildlife and other subjects where the photographer's
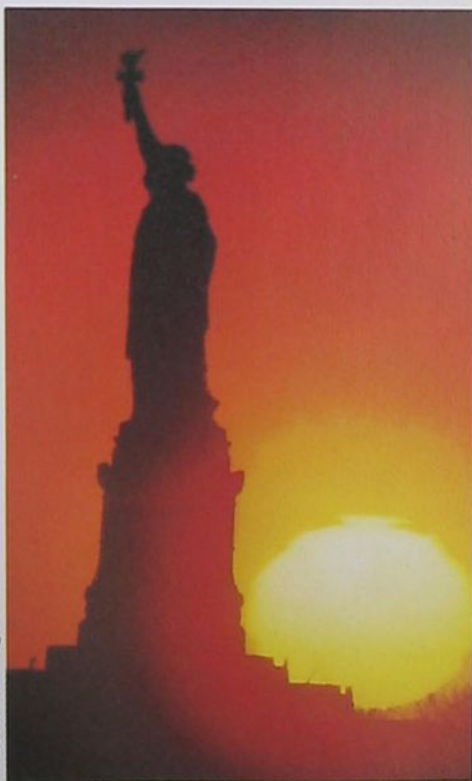
Y. Goto/The Image Bank

Shower *The selective view of a long telephoto was exploited here to isolate the figures standing behind the curtain of spray*

Statue of Liberty *Striking sunset pictures can be made with very long lenses but they look more striking still if a bold silhouette is included*

access to the subject is limited. Many images fail to generate impact simply because the photographer has not managed to get close enough to the subject so that the main area of interest is not sufficiently detailed and so there is too much extraneous space around it. Long telephotos overcome this problem with ease—even in the most commonplace situations—perhaps filling the frame with the face of a stranger standing on the other side of the street. This facility makes you look for other subjects, rarely seen at close range—cloud formations, for instance, make interesting subjects when seen through a 200 or 300 mm lens.

One of the most obvious ways of using a telephoto for everyday subjects, instead of just for the applications often listed as suited to them, is to exploit the narrow

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field of view to make highly selective compositions, picking out small details not readily apparent to the naked eye. By looking through a 300 mm lens, for instance, at a wide cityscape you can pick out unusual buildings and allow small sections of them to fill the frame. Try using the lens to compare old buildings with the new, or to create abstract compositions out of modern architectural designs. 500 mm mirror lenses are a particular favourite with some photographers, for with their narrow angle of

Giraffe café *The compression of these lenses can create juxtapositions and distorted comparisons of scale that are not apparent to the naked eye*

Spiral staircase *A long telephoto encourages the observation of small details and allows them to be made into strong graphic images*
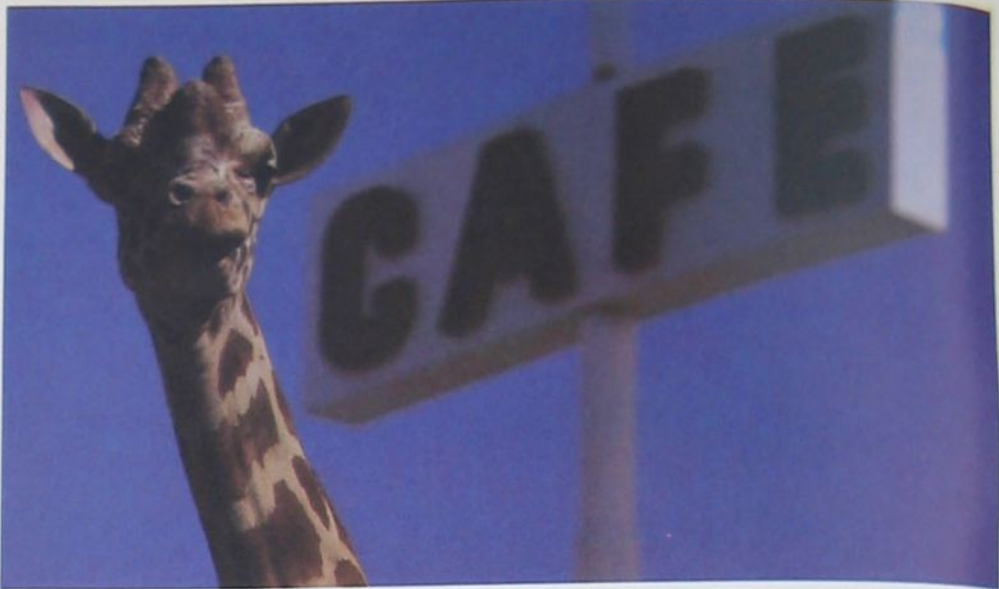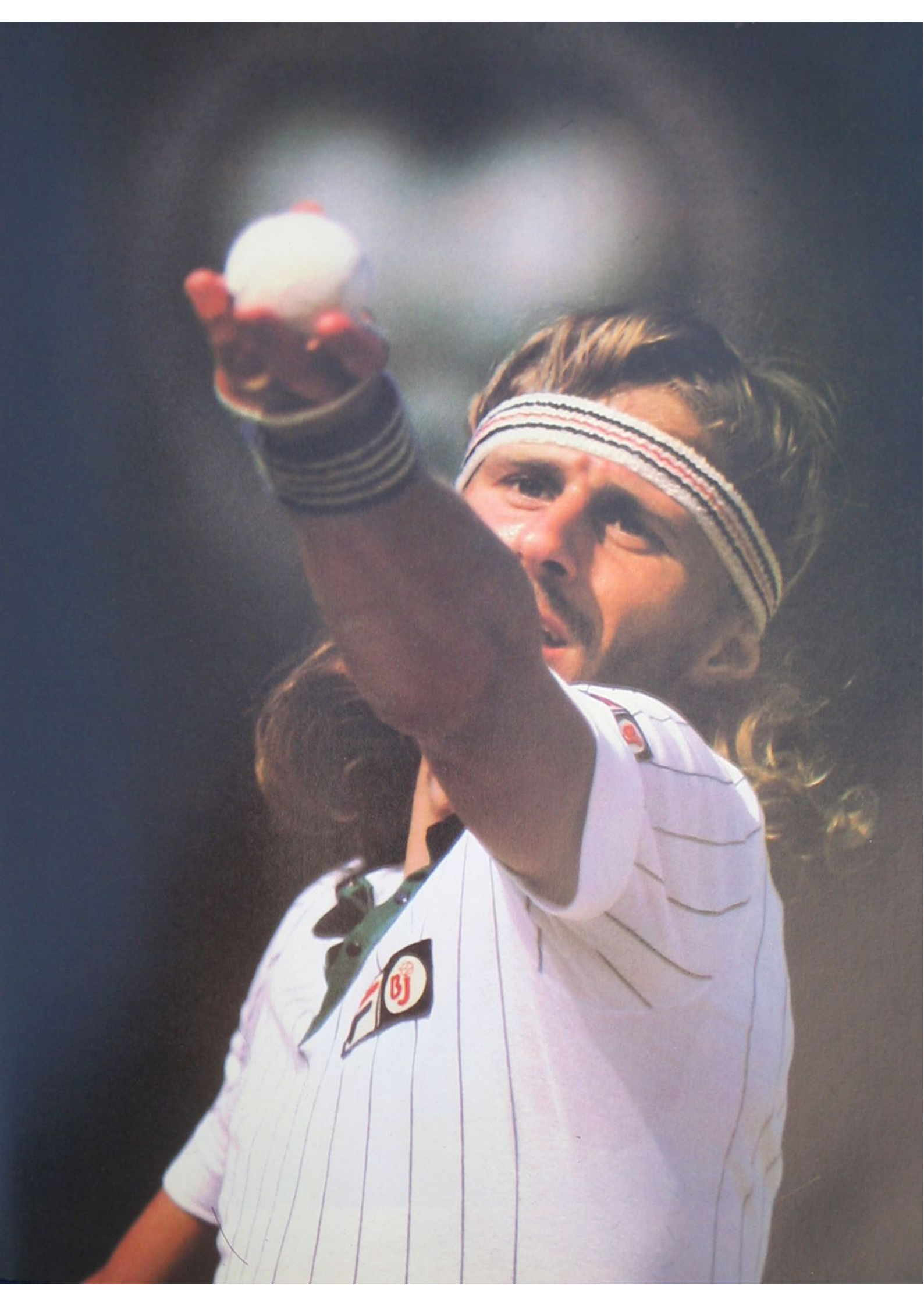
Anchor *Sometimes a detail is more striking than an overall view, but for close-ups of large subjects a long telephoto is essential*

Bjorn Borg *Lenses of this type are also indispensible for sport, allowing the photographer to fill the frame and eliminate distracting backgrounds*

view, flat perspective and almost total lack of depth of field, they can act almost like scissors—snipping out parts of the world around you. This can enable you to transform a scene into flat blocks of colour, tone and texture, isolating shapes and patterns and taking away any sense of form from three-dimensional objects.

In landscape photography the ability to be able to pick out details from a sweeping view is a valuable attribute. For this reason, many landscape photo-

graphers are found more often with a 200 or 300 mm lens than with a wide angle. These telephotos can allow you to pick out particularly attractive features of the landscape—patterned fields, shapely trees or perhaps a distant farm building to give a sense of scale to a wider area. On a more practical note, long telephotos allow you to reach well beyond, for example, a boring foreground and to concentrate on the main area of interest.

Associated with this selectivity is a telephoto's ability to create striking juxtapositions. A small foreground object, for instance, can be made to appear the same size as a huge building in the background. Similarly, two totally incompatible subjects can be made to relate to one another in terms of spatial positioning. For instance, a yacht sailing on the lake in a city park can appear to be floating on the very doorsteps of skyscrapers up in the background.

This ability to juxtapose unusual subjects is also an ideal way of bringing colour to a fairly monochrome scene. With a 300 or 400 mm lens you might try

Mountain lion *The magnifying effect has an obvious application in wildlife photography where the subject is often some distance away*

Water skier *Getting close to the subject helps create impact but it is also essential to look for dynamic or interesting shapes in the frame*

Construction *Here the compressed perspective helped lead the eye to the construction worker and made the rods a feature rather than a distraction*

Bagged fish *A long lens is ideal for picking out and emphasizing a detail that might otherwise go unnoticed—like the bag in the boy's hand*

Stephen J. Krasemann/DRK Photo

Steve Powell/All-Sport

Vautier/de Nanxe

John Garrett
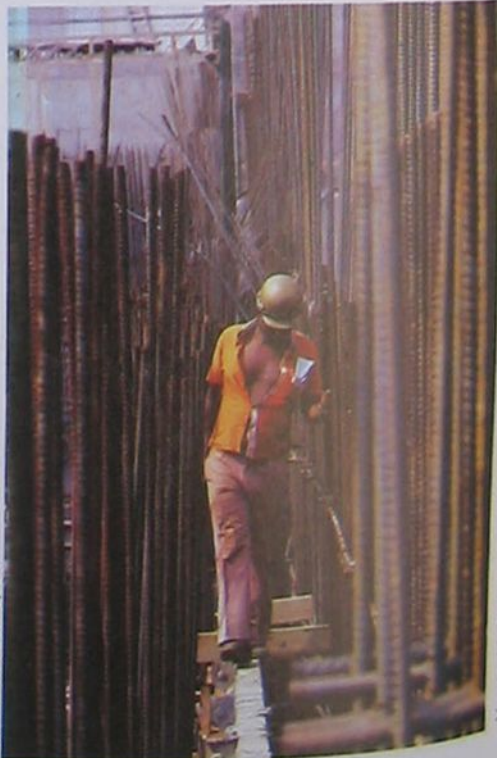
photographing a landscape or cityscape but shooting through a colourful row of flowers, defocused in the foreground. Alternatively, the foreground could be made a sharp and important element of a scene. An illuminated street lamp or traffic light could be composed against a background of an office building. If you choose your viewpoint with care and stop the lens down all the way, both elements will be sharp and the juxta-positions can be striking.

Another way long telephotos can be used creatively is to exploit the extremely shallow depth of field that these lenses have. By shooting at wide apertures, the background will be rendered an indistinct blur while the main subject is given prominence since it has been lifted away from its surroundings. This feature of long lenses is a great advantage with subjects like sport—for instance, a tennis player can be isolated from a distracting background.

Once you start experimenting with lenses of extremely long focal length—say an 800 mm or even 1000 mm or more—the creative possibilities are unlimited. Huge suns or moons can be composed in a frame or photographed in conjunction with an ordinary scene—perhaps using the extreme telephoto for one exposure and making a second exposure with a lens of more modest focal length (see page 513). The total lack of depth can also be used creatively for strong graphic designs carefully framed by scanning your surroundings through the viewfinder and picking out shapes that could otherwise pass unnoticed.

While exciting pictures can be made in this random approach—sweeping your surroundings and looking through the viewfinder at the shapes that appear—most strong telephoto images are created by the photographer's awareness of what makes a particularly good subject for the lens. For instance, the foreshortening effect can be exploited to emphasize the curves in a winding road while the tunnelling effect of an arched wooded gladed can be further exaggerated. Rows of cars held up in traffic, or of lamps lining a busy motorway are both similar subjects which can often be used to create dynamic images using a long telephoto.

Telephotos longer than 200 mm un-deniably have great creative potential and can allow you to create exciting and unusual photographs—simply because they 'see' things in a totally different way to the human eye. However, in order not to be disappointed with the results, remember that using long lenses entails various technical problems, not the least or which is camera shake and mirror vibration. To get the most out of your long telephoto shots, you will need to get into the habit of using a tripod at all times and using your camera's mirror lock facility, where fitted. The unusual optical charac-teristics of these lenses will only have impact if your final prints or trans-parencies are perfectly sharp.

Movie versus video

Competition in the market place between video and movie equipment has never been greater, and it promises to become even keener. With many conflicting claims from both sides, how do you choose between them?

When portable video recorders and cameras first came on the market, people predicted the early demise of home movie equipment. Home movies have always had a rather small band of devotees, and the archetypal 8 mm movie camera user has a small child whose progress is lovingly filmed. The camera is brought out for weddings and holidays, and the results shown at special movie nights, with all the ceremony of setting up the projector and screen, blacking out the room and rearranging the furniture in order to see films lasting a mere 210 seconds each.

Video, on the other hand, offers three hour tapes which you can view on your television set. No preparation is needed, since the video recorder is usually connected to the set for recording the TV output. And there is no need to send the tapes off for processing—you can view them straight away, and even reuse the tape to record fresh material, just as you can any other recording tape.

But the decision to go in for video rather than film is not at all clear cut. There is much more to be considered, and there are many circumstances in which film is preferable. To find out why, one needs to look at the video equipment itself, and then compare its features with movie equipment.

The equipment needed for video recording is much more bulky than that for movie work. As well as the camera,

Video and movie compared
Choosing between the two systems can be difficult because there are good points as well as drawbacks with both. The image quality of movie (inset below) is clearly superior, and a movie camera is much more portable—but video wins out for versatility and low running cost
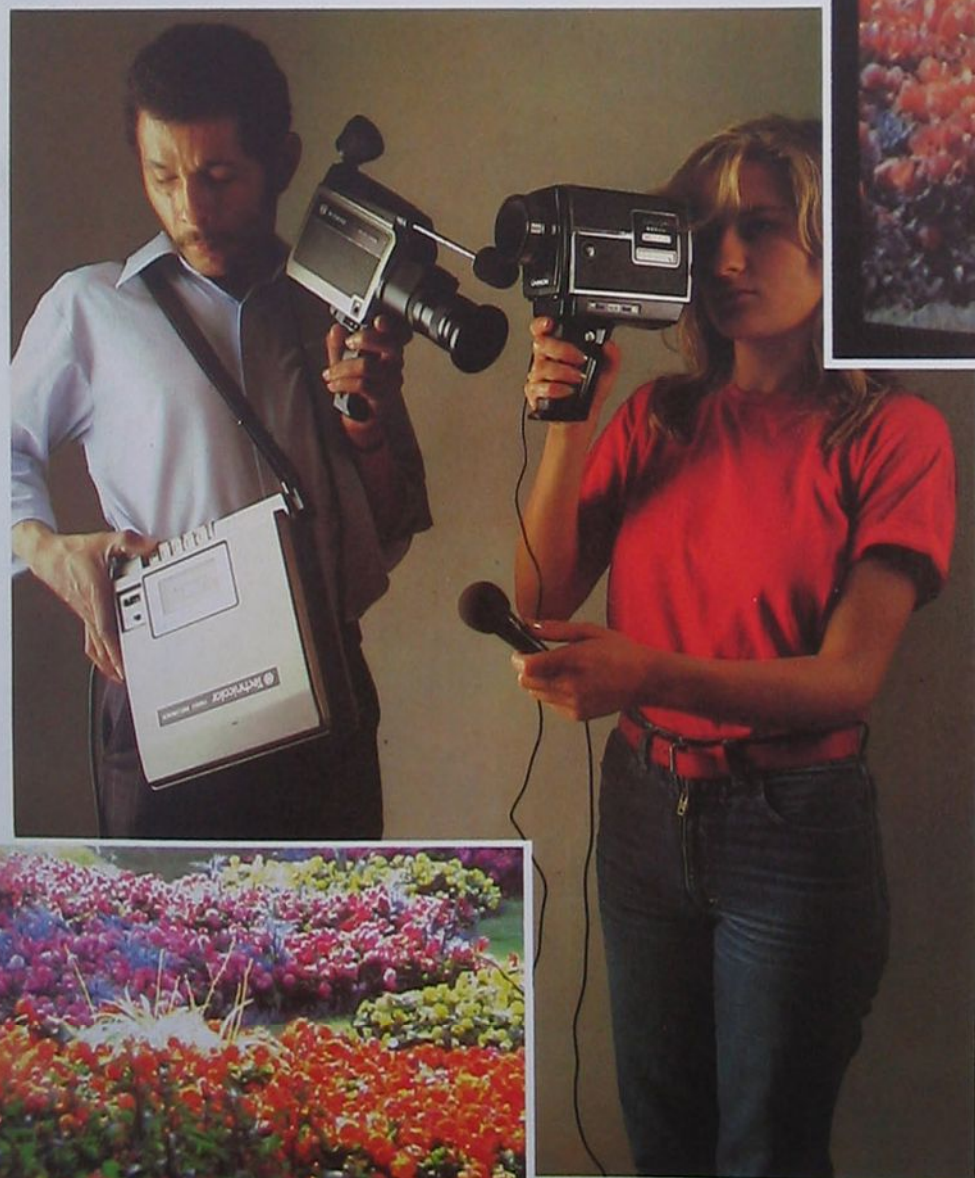
there is a recorder containing a rechargeable battery pack, which is quite heavy. If you are running the camera from the mains electricity, you use an AC adapter and rectifier which converts AC into DC—instead of the battery pack.

Video cameras
The basic video camera is about the same size as a sound movie camera, though rather lighter. It is connected to the recorder or AC adapter by a heavy duty cable, usually some 3 m long. The lens is usually a zoom, with a fairly fast maximum aperture of $f/1.4$, and a zoom range of about six times minimum focal length, from wide angle to telephoto. The format is similar to 16 mm movies, so the actual focal lengths are about half those of 35 mm for a given effect. A maximum focal length of 70 mm, for example, gives the telephoto effect that one would expect from a 140 mm lens on 35 mm.

There is an iris diaphragm on the lens, but on some cameras adjusting it does not change the picture brightness. This is because the image brightness is controlled electronically, so if you stop

down the lens, the picture automatically remains at the same brightness. The iris simply allows you to control the depth of field. On other cameras, the iris diaphragm does control brightness automatically through a servo motor. You can observe the diaphragm in motion if you look through the front of the lens while the lighting is varied, for example, after covering and uncovering the lens quickly with a card or hand.

There is often a manual override on the automatic exposure control and this is a feature worth having as the electronic image can only cope with a limited brightness range. Very often a light sky or, when indoors, a window, will flood the exposure control and leave you with a well-exposed sky or window frame but darkness everywhere else. The exposure override allows you to compensate for such highlights, with its backlight control.

Most cameras have another control not found on movie cameras—for colour balance, sometimes called the 'white' control. This adjusts the output of the colours to allow for the colour temperature of the scene. On many cameras this is automatic, and carries out an 'integration to grey' as on a colour analyzer (see page 1552) to give an overall balance of colour. There is an override to allow you to correct for unusual subjects, and often a set of optical filters inside the camera to give the basic correction for different light sources. Some cameras do not have an auto white control, but instead have a

Typical features *on a video camera include sensitivity, iris diaphragm and colour balance controls, a zoom lens operated manually or by motor drive and a built-in microphone. Some cameras incorporate a fader control which, when selected, causes the image to fade in or out gently instead of abruptly. An electronic viewfinder doubles as monitor, through which shots are composed, or viewed after recording. The scene is viewed in detail through an eye lens, which can be flipped out of view to reveal a ground glass viewing screen*
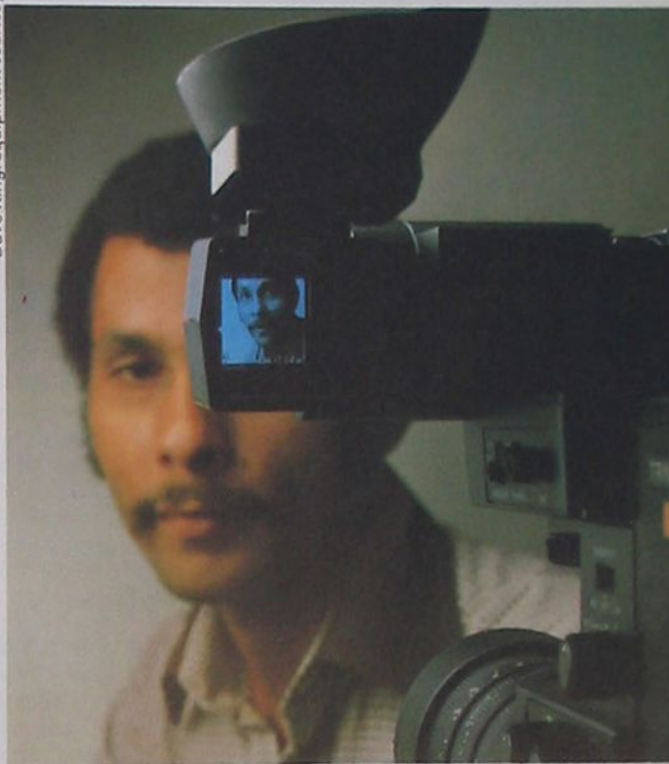
small meter on the side of the camera whose needle shows the redness or blueness of the lighting. You must centralize the needle for correct colour.
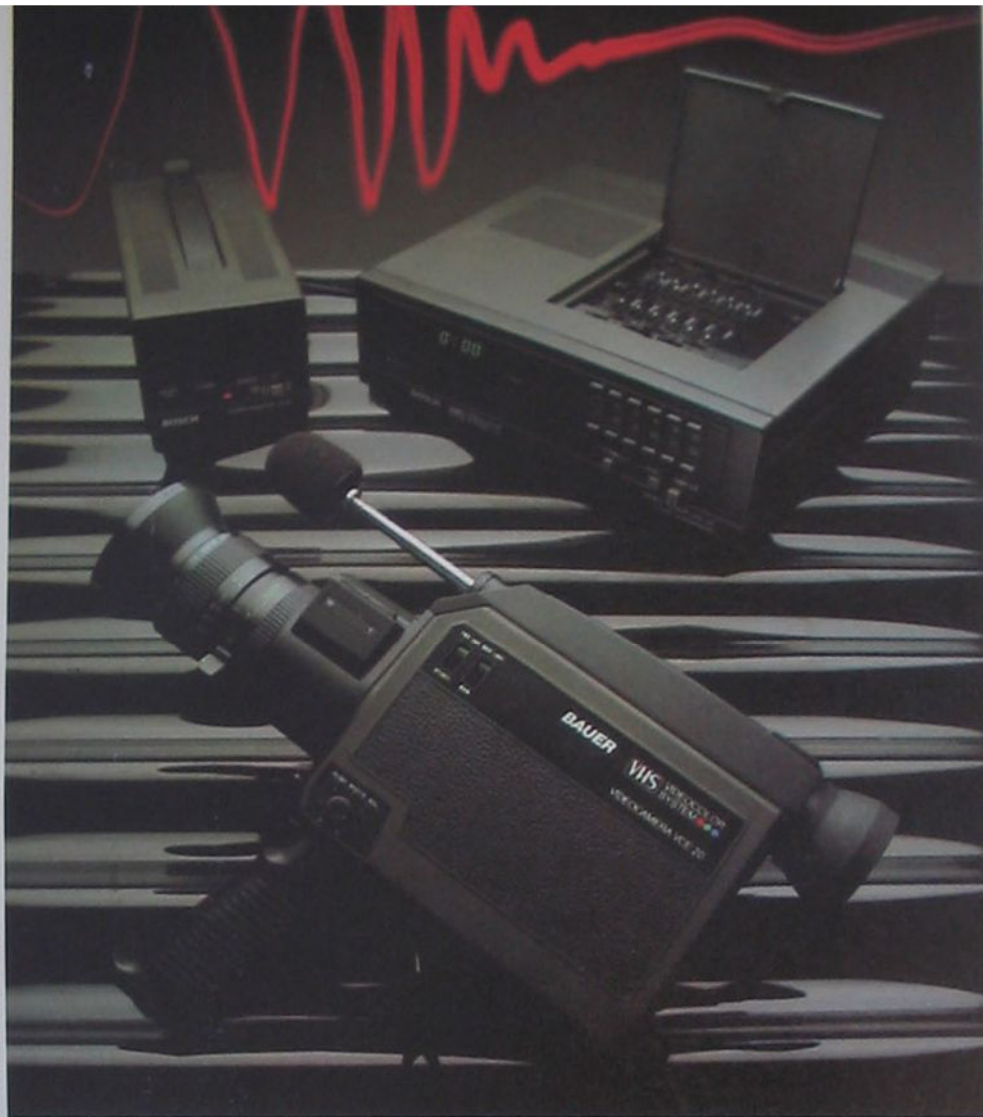
Control of colour balance seems to be more of a problem with electronic cameras than it does with film, and while it is easy to balance for tungsten lighting, any trace of daylight in the same scene will appear very blue, giving a weird cast to faces.

A sensitivity switch gives greater tube sensitivity in dim lighting, with slightly worse picture quality. If you are likely to do a large amount of available light work, it is worth comparing the tube sensitivities of the various models. These are given in terms of the dimmest illumination that give a picture, quoted in lux (see page 2346). A typical tungsten-lit

interior has a brightness of 50 to 75 lux, while a sensitive video camera at full aperture has a sensitivity of 30 lux.

Sound is picked up by a microphone on the camera. Unless this can be extended away from the camera on a short boom it may pick up the breathing of the camera user, so there is usually a jackplug which allows you to attach an external microphone, and a headphone socket so that you can monitor what is being recorded. The camera is completely silent in operation, so there is no need for a sound shield—though there may be an audible click as you begin the recording and noise from a motorized zoom may be picked up. Recording is done by setting the recorder to its record position, then controlling it by means of a pause button on the camera.

frame and so on. The lightest currently available weighs around 3 kg, while the average is nearer 5 kg, including the battery pack, which weighs about 800 g.

The weight of the recorder depends very much on the tape format being used. There are an increasing number of formats on the home recording market. VHS and Betamax are the principal ones, though there are now systems which use non-standard formats. Technicolor cassettes are almost the same size as audio Compact Cassettes, though using 6.25 mm tape, while JVC are introducing a system called VHS-C. This uses the standard 12.7 mm VHS tape, but with a much smaller cassette. The tape lasts just 30 mins, and the cassette can be used in a conventional machine using an adapter which is the same size as a standard VHS cassette. The VHS-C recorder weighs just 2 kg without batteries.

Other manufacturers are developing formats which will combine the camera and the recorder, so that only a single unit will be needed. Meanwhile, the weight and bulk of recording units restricts their popularlity.

All manufacturers offer a tuner unit, matching the recorder, which allows the recorder to be used for recording TV programmes like a home mains recorder. The tuners operate only off mains voltage, and usually function as an AC adapter for using the camera in the home, and as a battery charger. Home video recorders can also be used to record the signals from a video camera. Most have a socket which accepts the camera's video signal.

The viewfinder is usually a small black and white picture tube (a cathode ray tube or CRT) which shows exactly what is being picked up. Some models have indicators in the viewfinder to show when you are recording and when the scene is too dim for a good picture. A useful feature is a switch on the camera to allow you to use the CRT as a monitor to view what you have already recorded —essential when you are on location.

The video recorder
A portable video recorder is usually much heavier and more bulky than an audio cassette recorder. It usually has a wide range of controls, such as are found on home recorders—fast run, freeze
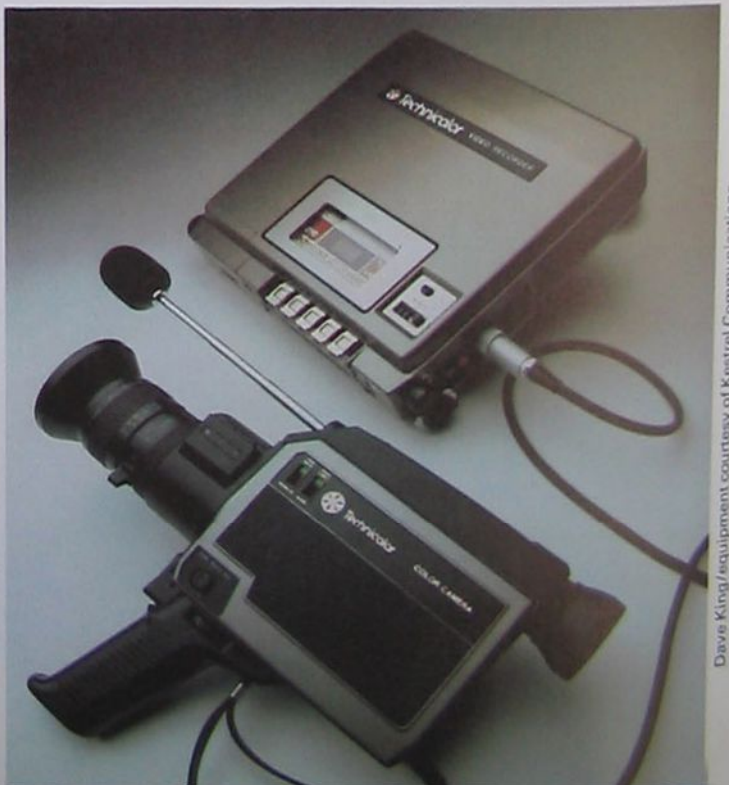
Picture quality
How does the picture from a portable video system compare with that from a Super-8 movie camera? In all respects, the movie film is superior—colour definition and brightness range are visibly better. The definition of a home video recorder is equivalent to a picture with

An AC adapter (left background, above) powers a video tuner (right background) and recorder, and recharges the video recorder's battery pack automatically

A complete video system (left) includes a recorder, camera, tuner and remote control. The tuner incorporates an AC mains adapter and battery charger

For outdoor filming, all that is needed is a portable recorder with a charged battery and a video camera. The recorded tape is played back through a TV set

only about 250 lines, though the picture actually has the usual 625 lines (525 in Canada). A Super-8 picture has better quality than even a 625-line studio camera.

Furthermore, the Super-8 picture can be shown on a large screen, while video is restricted to the size of the screen on your television set.

Portable video cameras give poorer

Cassettes A major difference between video systems is the cassette design. Each has its own way of loading the tape on to the recording head and keeping it tensioned and aligned

Dave King/equipment courtesy of Kestrel Communications

Dave King/equipment by Sony (UK) Ltd./Kestrel Communications

Battery packs vary in size and capacity with the make. Typically, charging time is an hour, and the charge lasts for about an hour. The pack is loaded into the portable recorder

recorder is connected to the home television set as a matter of course. Any sequence on the tape can be selected and shown in a matter of minutes, while a movie film requires a considerable amount of setting up. Film, of course, is not available for instant replay but must be processed after shooting.

quality than studio cameras, and even the expensive professional cameras cannot match studio camera quality. Such cameras are sometimes called *ENG* cameras, from their use for Electronic News Gathering for television news bulletins.

The lifetime of videotape is limited. After a few plays, the picture may be affected by *dropouts*—white specks on the image caused by wear of the magnetic coating. Tapes can be accidentally erased, either by recording over them or by leaving them close to a magnet, such as found in loudspeakers.

Film, on the other hand, can last tens of years, though unless properly stored it can become brittle. But Kodachrome films made 30 years ago retain their colour and sparkle, though the more they are shown, the greater the risk of scratches.

Editing and copying
Film can be edited easily (see page 1774), but it is not possible to cut and edit videotape in the same way. The only practical means of editing is to link your recorder with another, using the video input and output sockets of each, and copy the sequences you want in the correct order. Quality suffers when a copy is made, and sometimes tapes made

on one make of machine will not play well on another make of machine of the same format. The result, however, is still quite viewable.

While this technique requires you to acquire or borrow another machine, it does make copying of your recordings very much cheaper and simpler than copying an 8 mm film, which has to be carried out by a professional transfer studio at no small cost.

Convenience
A video system is inevitably much more bulky to carry around than a movie camera. Some video cameras are designed to be used mounted on the operator's shoulder, while there are various devices, such as backpacks, to help carry the load of the video recorder. A movie camera, on the other hand, can be hand held and is easily carried around in luggage.

The full size video cassettes are bulky compared with Super-8 cartridges, but hold enough tape for several hours' recording, compared with just 3½ minutes for Super-8. A fully charged set of batteries lasts for an hour, and recharging takes about an hour.

While video is inconvenient during location recording, playback is easier than with a movie film, assuming that the

Cost
For many people, cost is the deciding factor. Video equipment costs from two to three times as much as a sound movie camera and projector, but the cost of tape is lower than that of film—a three hour tape costs less than two 3½ minute sound movie films. There are numerous advanced mechanisms in a video recorder, however, so over a five year period the running costs of video could be high—video heads have a limited lifetime. Movie repair costs are likely to be lower, since the equipment is basically simpler. The question of cost therefore can only be decided on the basis of the use you are likely to get from the system.

Which should you choose?
There are pros and cons for each system. Video is fine for anyone with a keen interest in making documentaries, or who wants to record family life in detail. Super-8 is better for both the occasional family film, and for the dedicated film maker who wants high quality results which can be edited. Anyone who travels widely will find Super-8 more convenient, since the camera is light, and film is available everywhere in the world. As a medium, it has many advantages over video. The question is, which drawbacks, those of film or video, do you prefer to put up with?

EXPOSURE

Getting the correct exposure on your negative and slides means much more than simply measuring the light. But everyone takes it for granted—until something goes wrong

Jason Shenai

Which exposure? These two shots had identical lighting and exposure, yet the right hand one looks darker because of the angle of the lighting

In practice, the biggest single technical problem facing the photographer is that of achieving correct exposure. After a little experience, and with the help of modern metering systems, most photographers manage to get the majority of exposures right, without ever really knowing why. Yet to find out the best exposure for each and every subject and keep under- and over-exposure to a minimum, it is important to understand just what does make a correct exposure.

In the early days of photography, exposure was very much a hit and miss affair and photographers achieved their results largely through trial and error. However, two amateur photographers who were scientists, F. Hurter and V. C. Driffield, found this approach to exposure unsatisfactory and, in 1876, began a long series of scientific tests to establish precisely how emulsions did respond to given quantity of light. Their experiments consisted essentially of administering measured doses of light—with the aid of the rotating wheel from an adapted sewing machine—to an emulsion and measuring the density of the result. When they published their results in a paper entitled *Photochemical Investigations and a New Method of Determination of the Sensitiveness of Photographic Plates* in 1890, they referred to their equipment as a *sensitometer.* The term *sensitometry* has since been widely adopted to describe this kind of work.

Sensitometry is the scientific study of the sensitivity of photographic emulsions. It is basically concerned with the overall *performance* of the emulsion—that is, the amount of light needed to produce a certain *blackness* or density in the negative. Many sensitometric standards have been set up over the years, such as the American Standards Association (ASA) and the German DIN systems, but all sensitometric tests work on the same principle. First of all, the photographic material under test is given a series of standard exposures in the sensitometer, whether this is a simple step wedge or a rotating wheel. The film or print is then processed in controlled conditions. Finally, the resulting densities of silver are measured with a densitometer. The densities can then be plotted against the exposure on a characteristic curve for the emulsion (see page 1518).

With the aid of the sensitometric information provided by the characteristic curve, it is possible to predict the precise effect of a given exposure. Every exposure value produces a certain film density. From this it might seem that we can decide what exposure is needed to give a certain film density (and so the 'correct' exposure) simply by referring to the characteristic curve for the film in use. In practice, it is not as simple as this. First, because exposure is partly a matter of personal preference; second, because every picture contains a whole range of exposures.

What is exposure?

The word exposure has come to have a number of meanings in photography, from the aperture-shutter speed combination to just the act of taking a picture. But in sensitometry, it has a very precise meaning. For any negative, exposure is essentially the amount of light that falls on the film. This depends upon two factors: the intensity of the light and the time it has to act up on the film.

For sensitometric calculations, the exposure is given by the equation:

$$E = I \times t$$

where E is the exposure, I is the illumination (the intensity of the light) and t is the time. Illumination is measured in *lux* (lumens/square metre) and the time in seconds. So exposure is therefore given in *lux seconds*. It is the log of this figure (log E) which is plotted for the characteristic curve.

In practice, the photographer can control the total illumination through the use of the aperture setting, and the exposure time with the aid of the shutter speed. However, the illumination varies over the frame because various parts of the subject reflect different amounts of light—this is, of course, the basis of the photographic image. So exposure varies over the frame area with subject brightness. This means there is not one single 'correct exposure' for every negative: each negative receives a whole range of exposures. And for any given negative, there is not just one log E value to be identified on the characteristic curve but a whole range.

With an 'overexposed' negative, the amount of light received from every part of the subject is large and so all the exposure values for the negative lie at the top end of the characteristic curve. This means that all the image is very dense. With an 'under-exposed' negative, the amount of light received is small and exposure values are all at the lower end of the curve. The resulting negative is very thin. In both cases, density range is limited and

so detail is lost in either shadows (underexposure) or highlights (overexposure). Correct exposure in the camera, therefore, is achieved when the range of exposures falls somewhere in between these extremes, so that the range of densities in the negative is as wide as possible.

Placing the exposure

Although some subjects have a range of brightnesses so wide that they cannot be accommodated by the film, for most subjects there are several camera exposures with modern b & w film that will give an exposure range that falls between the two extremes on the curve. The difference between the greatest camera exposure and the smallest is known as the *exposure latitude*. Only once the camera exposure falls outside this range it is under- or overexposed.

Clearly, every negative given a camera exposure within the exposure latitude will be acceptable, but it will not necessarily be the best possible. Looking at the characteristic curve you might imagine that the best camera exposure is one in which all the subject brightness lies on the straight line portion. However, for most subjects, practice has shown that the best exposure places the brightness range lower than this, so that some values fall on the upper part of the toe of the curve.

There are a number of advantages to placing the exposure partly on the toe. For instance, it means that camera exposure is kept to the minimum necessary to produce a good result. So if you need a fast shutter speed to stop action or a small aperture for maximum depth of field, it is available. Keeping exposure to a minimum also means that the chances of irradiation (see page 2184) are reduced. Although some shadow detail might be lost, modern printing papers are designed to account for this.

Determining exposure

Exposure tables and light-meters are all calibrated to give a camera exposure that falls on the right place on the curve. Unfortunately, they only work well for an 'average' subject—that is, one in which has a 'typical' maximum and minimum brightness and an even distribution over the entire brightness range.

To peg an exposure at the right place on the curve, one solution would be to measure the darkest part of the subject and the lightest part and calculate the exposure accordingly. Unfortunately, this is impractical, because shadow readings are difficult to take because of the poor sensitivity of light meters at low light levels, and because it is time consuming to make two readings and a complex calculation. It would be possible to measure the brightest part of the subject alone, but to make sure that shadows were properly exposed, you would have to give more exposure than is really necessary.

Another method is to select a *key tone*—that is, an important tone (such as skin) which you want to reproduce in the same way in every photo. The meter reading is taken from this key tone and exposure is calculated so that this key tone reproduces at a certain density.

Most light meters, including TTL meters, however, work on the *integrated* method. This means that they take a reading of the total amount of light falling on the subject and are calibrated to give a corresponding exposure. This is far from ideal because it is not the total amount of light that is important for correct exposure, it is the maximum and minimum brightness. An integrated reading gives less exposure for a subject with a large proportion of highlights than one with a large proportion of shadows. This means that in subjects with a lot of white, for instance, shadows are underexposed. However, in practice, the method is good enough for most subjects—providing you are aware of its limitations—and its simplicity makes it very easy to apply.

Finally, there is the *incident light* method in which the amount of light falling on the subject is measured, rather than that reflected. Although this sounds like an accurate method of determining the amount of light around, it is not a perfect guide to exposure. An incident light reading only gives the maximum brightness and ignores the shadows. So no method is foolproof.

Where to place the exposure

density

log exposure

exposure range in picture

density

log exposure

exposure range in picture
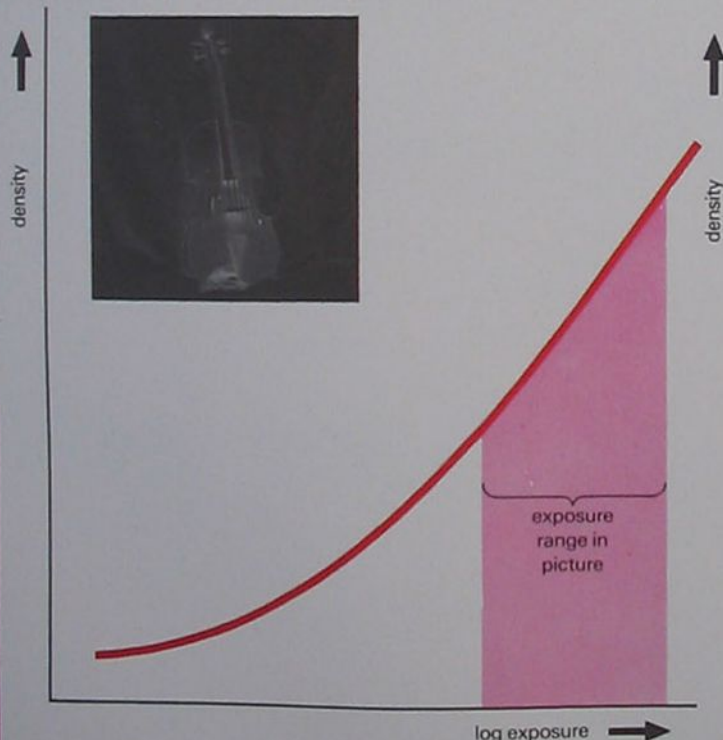
Dense neg *This negative is exposed so that its tonal range falls on the straight line part of the characteristic curve—yet the prints are not ideal as graininess increases with density*
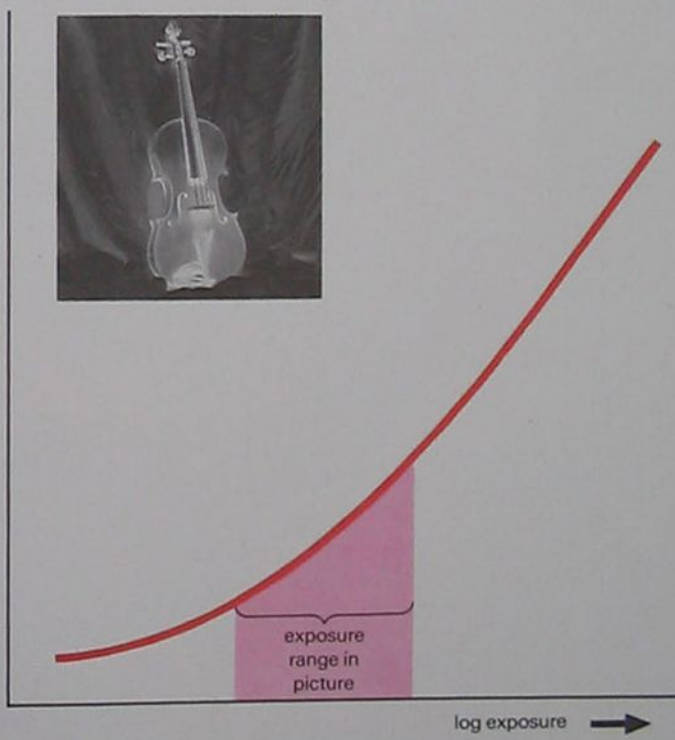
Lighter neg *With less exposure, all essential details remain on the curve, yet the resulting print will have finer grain. Giving less exposure allows you to stop the lens down further*

David Muench

Through his large format photography of America's most outstanding areas of natural beauty, David Muench has revealed a seldom seen range and variety of landscape in all weathers and seasons

In the landscapes of the Californian photographer David Muench, desert scenes resemble the sensuous folds of the human body and magical sunlit waterfalls appear suddenly out of the misty and dramatic heights of distant crags. Indeed, whatever type of landscape Muench captures on film he always manages to convey not only its natural beauty but also, and above all, the atmosphere of the place.

He takes pictures of everything from deserts to rain forests and swamps to mountain ranges, working in every season and at all times of the day. And the character of his landscapes is shown as timeless—untouched by the influence of man and the ravages of civilization.

Muench is now world-famous for his superb landscapes. They have appeared in an enormous number of books—including 15 that are solely illustrated by his own photography. Besides having a thriving market among publishers and private buyers of photo-graphic prints, his pictures also sell for use in publicity and corporate reports.

For Muench, photographing nature has been a way of life ever since, at the age of 15, he began to accompany his father, Joseph Muench, on photographic trips through the vast wild areas of the western United States. At that time he used his father's cameras but in his late teens he decided to take up photography as a career himself.

Over the next few years Muench studied photography, first at the University of California at Santa Barbara, and then at the Rochester Institute of Technology in New York State. Fellow students included Pete Turner (see page 1908) and Jerry Uelsmann, who were both also to gain prominence in different photographic fields.

Finally Muench returned to the west coast to attend the Los Angeles Art Center where he graduated with a BA in photography—fully versed in the areas of architectural, fashion, food and

**Cascade Falls,** *Umpqua River, Oregon*

advertising photography.

However, landscape photography was his first love and soon he was following in his father's footsteps as one of the main contributors to the large format ecological magazine *Arizona Highways.*

Muench would still recommend a school of photography to anyone seriously interested in a photographic career. 'The only exception would be someone who was both very brilliant and very bullish. I think it is very important to learn all the elements of technique and I also think people have to learn the high energy that it takes to be a good photographer. I'm lucky enough to always have a high energy level but some people have to work hard to maintain it.'

It is this energy that keeps Muench moving between remote spots all over the United States and in all weathers.

Upper Navajo *Canyon, Arizona*
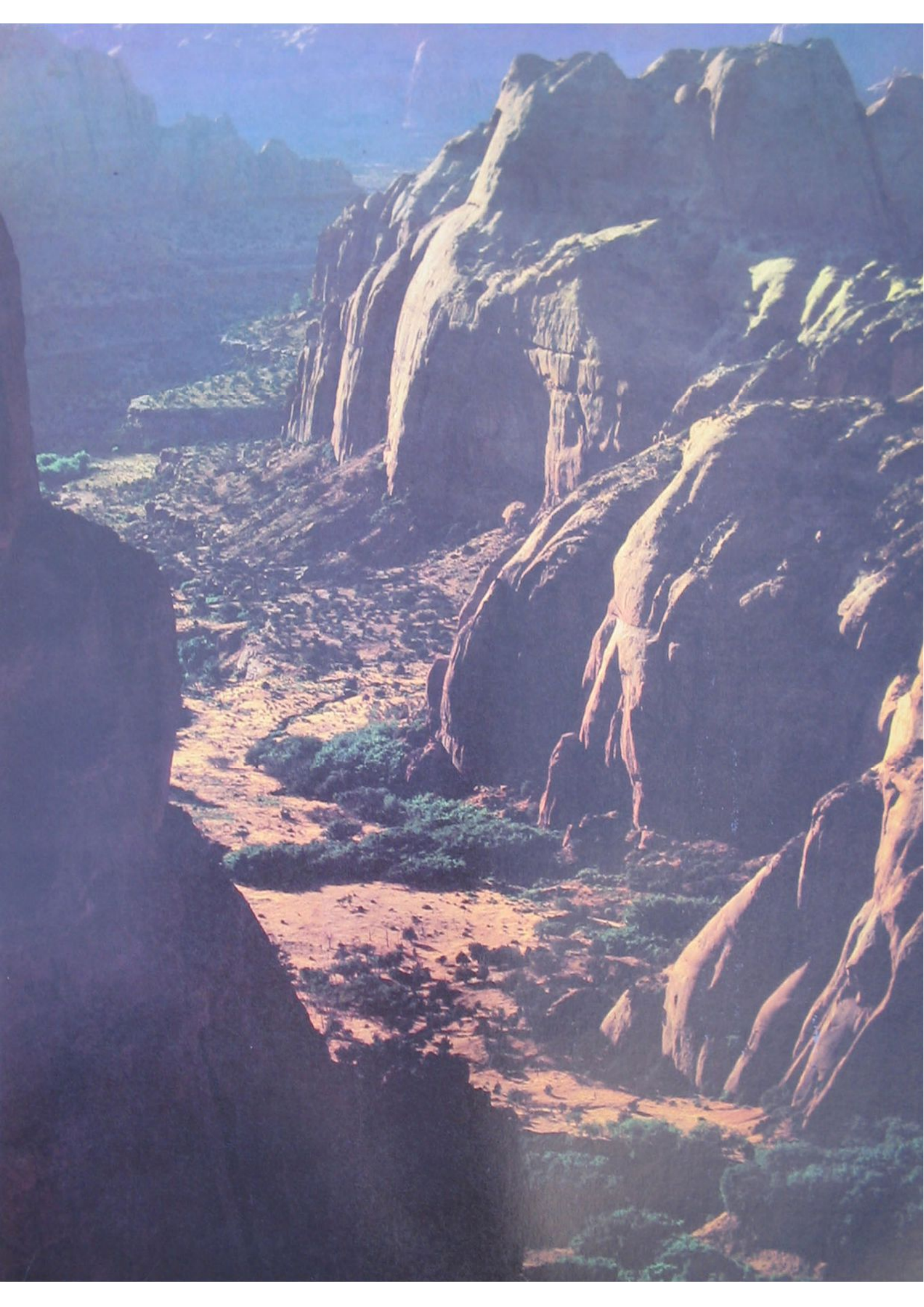
Elioha River, *Olympic National Park, Washington*

And he has produced photographic books showing some of America's most outstanding areas of natural beauty including the Californian coast, Arizona, Colorado, the Sierra Nevada and the US National Parks. Although he largely confines his photography to North America he would now like to travel the world to photograph different aspects of one of his favourite subjects—the desert. He is fascinated by the variety and beauty of desert landscapes which he feels are more interesting than most people realize. They were the subject of one of his favourite books, *Desert Images*—a book which he worked on with the writer Edward Abbey.

Depending on the type of landscape and the situation he is in, Muench finds that almost every subject requires a completely different approach. He will thus use different methods, points-of-view and techniques when photographing a rugged coastline or a mountain canyon. Once he has defined for himself the kind of emotion that a particular landscape evokes, he is primarily interested in trying to communicate that emotion on film.

The magnificent landscapes that Muench produces are also the product of a considerable amount of self-discipline, organization, care and patience.

Any one of his trips may take him away from his home for several months at a time. So he will spend as much time as possible before any trip in making a schedule with an established itinerary of possible locations. Indeed one of his favourite pastimes is the study of

David Muench/The Image Bank

Snake River Overlook, *Grand Tetons National Park, Wyoming*

David Muench
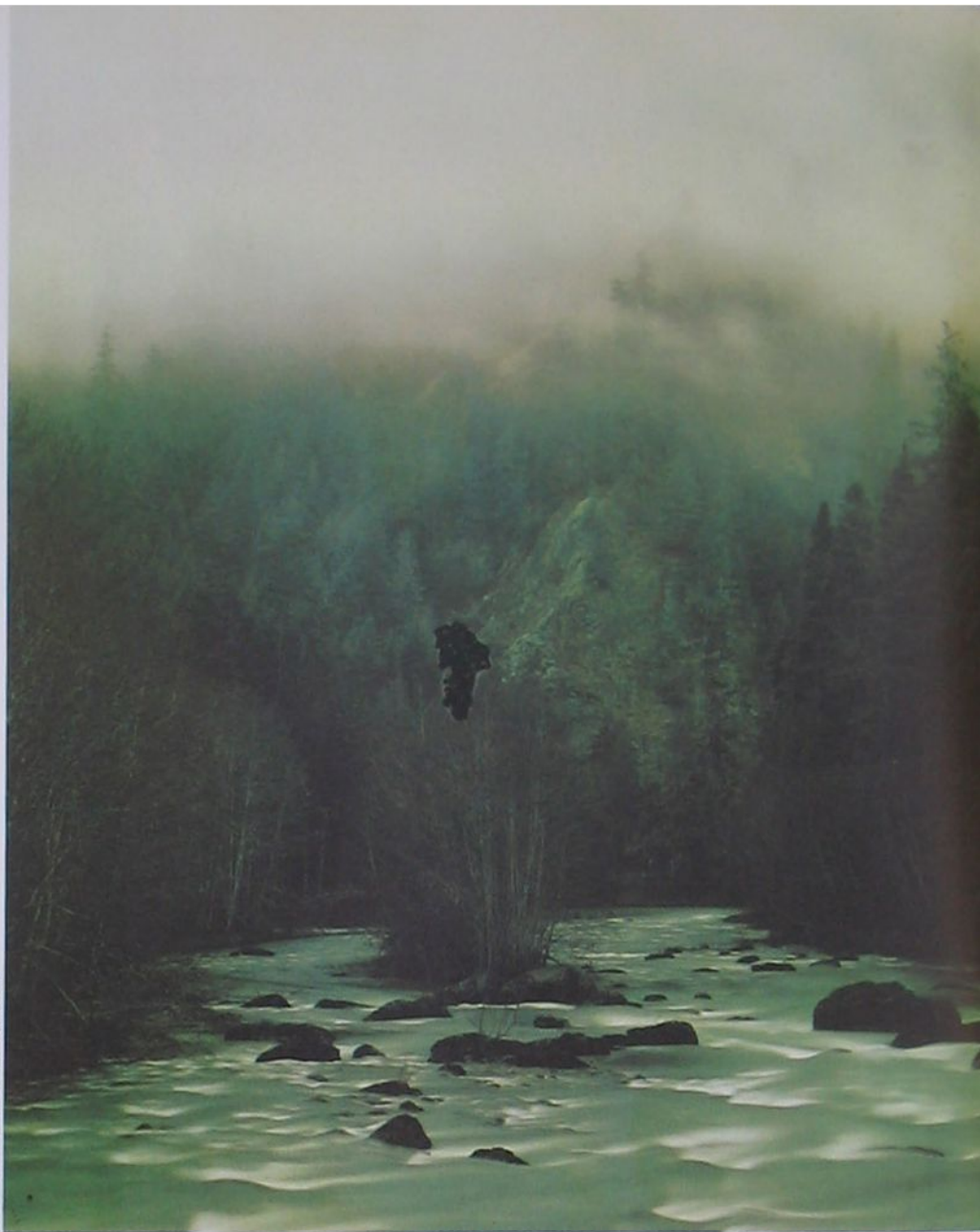
topographical maps so that when he visits a new area he already feels at home there.

Muench also enjoys the sheer delight of exploring and discovering. Although an itinerary is essential he allows himself to digress and deviate from his established framework at whim—moving from one location to another as photographic possibilities unfold before him.

His only rigid criterion on such a trip is to make at least one photograph every day. 'Only if it is a totally cold, blank day will I allow myself the luxury of a good, long breakfast or a day of just exploring.'

However, Muench is rarely discouraged by extremes of weather. Heavy rain or storms are likely to make him feel more confident rather than less, as they consititute one of the greatest challenges for a landscape photographer. He is more likely to worry if his work appears to be going very smoothly, as he knows that problems often lead to his most interesting pictures.

For any landscape photographer, being in 'the right place at the right time' is a rare event. It is a field of photography that seldom benefits from scoops or

David Muench/The Image Bank

Snowdrifts banked up at the foot of the Sneffels Range, Colorado

distances, so he generally works from his large four-wheel drive station-wagon which travels well on highways and over rough ground. It is also a useful store for all his equipment.

Muench practically always works with large format cameras—generally a Linhof. He has five of these view cameras and alternates them, as at least one is invariably being repaired after being dropped from a cliff or plunged in an icy mountain stream. Going to extremes in obtaining remarkable pictures often puts a strain on his equipment.

Although he works with both the 8 × 10 and 4 × 5 inch format, he favours 4 × 5 and uses the complete range of lenses from a fish-eye to 800 mm. He will take a 4 × 5 view camera even if he has to hike to areas which are inaccessible by road. Packing this, as many lenses as he can carry and 100 film holders usually means that he limits his personal baggage to a sleeping bag and a few sandwiches—even on a trip of two to three days.

On such a trip he will also take a 35 mm system—generally his Leicaflex and a 75 mm and 210 mm lens. However his preference is still to use the larger format wherever possible as the picture quality is so much better. Also he finds that the sheer unwieldiness of the large format process actually helps him to make better pictures—composing images that communicate a strong sense of place.

Muench also enjoys the process of setting up his camera in the precise location he has finally decided on and composing his picture through the large ground glass screen. Using a 35 mm

**Live oak and pool** at the Aransas Wildlife Refuge near Corpus Christi, Texas

lucky chances. A landscape photographer often owes his best pictures to a process of patience and persistence. As Muench explains, most people miss some of the most beautiful places on earth simple because they cannot be bothered to explore.

Muench may cover any one area several times over as he knows that such persistence will frequently reveal a new angle or viewpoint of a particular landscape. Landscapes may also look completely different at different times of day, so that a view that appeared unremarkable at midday may be transformed when seen at dusk.

In the search for one such picture, Muench once climbed to the top of Table Mountain in Wyoming to get a particular view of Jefferson Mountain seen through the Teton mountain range. After taking what he calls 'some rather dull pictures' at dusk he waited patiently through the cold night to photograph the same view at sunrise. Only after getting the pictures he wanted, did he trek wearily back down the mountain to civilization.

The remote areas that Muench photographs may often involve travelling long

David Muench/The Image Bank

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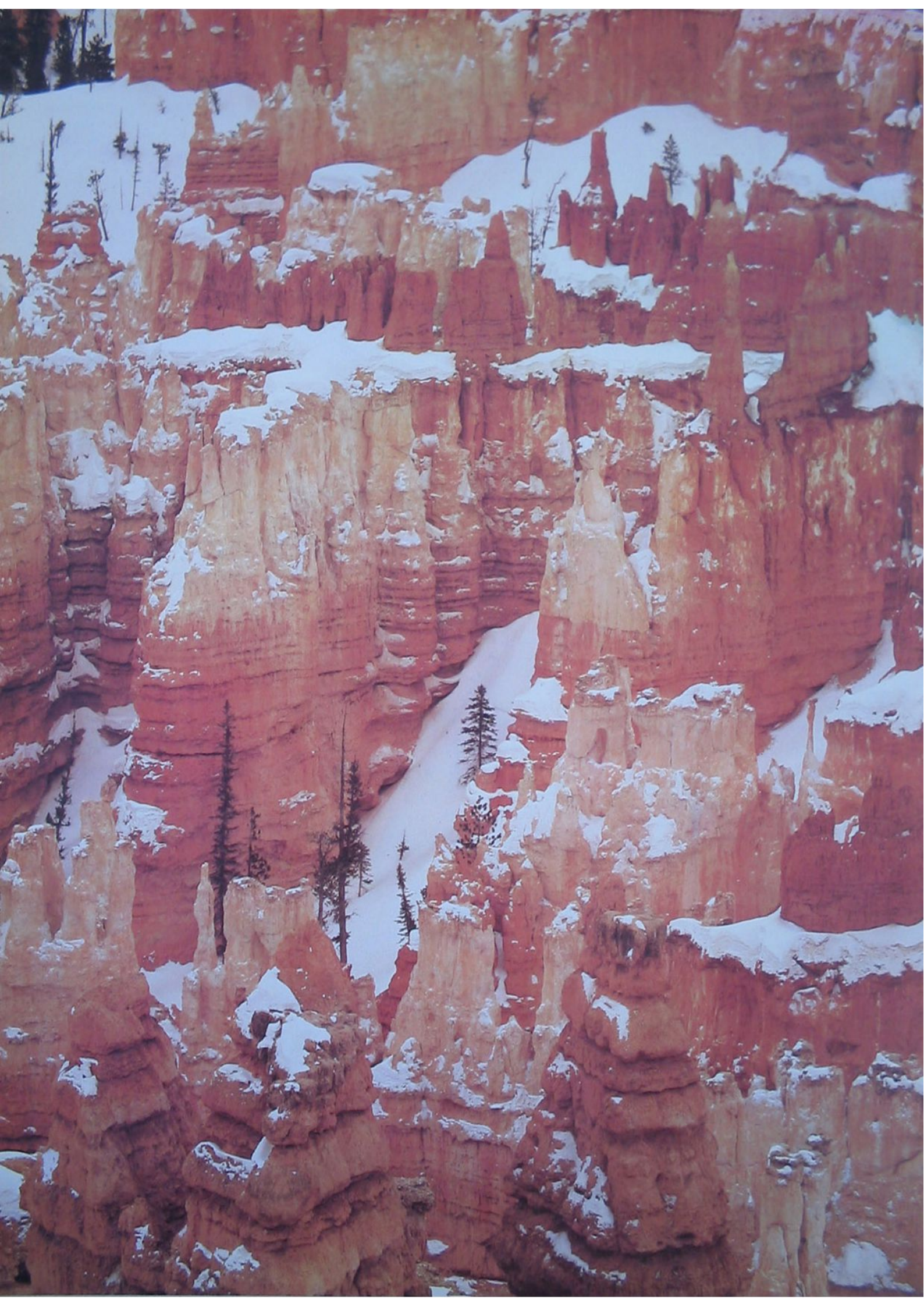
camera is much too fast a process for him although he can sometimes regret this lack of speed. Like any other professional photographer, Muench likes to bracket his film whenever possible in pursuit of the perfect exposure and also to take both verticals and horizontals of the same scene. With a 35 mm camera this can be done quickly and effortlessly, but with view cameras it can be quite a different story. 'Sometimes, I am at the top of a mountain and I am working like mad, with film and holders flying all over the place. At that rate I should really be filming! I invariably miss things.'

For his 35 mm colour photography Muench uses Kodachrome film exclusively, while for his black and white work

travelling round the state often returning to the same place to photograph it in different seasons.

Another satisfying project was his retracing of the route of the famous Lewis and Clark Expedition of 1805 to the Mississippi–Missouri basin. This also took a year to complete and the remarkable results are now displayed at the Jefferson Expansion Memorial in St Louis, Missouri. Nearly 400 of his photographs are displayed—including 33 large murals—in an exhibition devoted to Lewis and Clark.

On all these expeditions he spends most of his time working alone, although occasionally his wife or children will go with him and help him with his equip-

his 'stock' pictures and from generally self-financed expeditions. He goes to the places he likes and then markets the finished material when it is ready and where it is suitable.

He is particularly reluctant to accept advertising commissions because he does not feel he can keep to his high standards if he has to guarantee a good picture on any day—unpredictable weather always makes this a risk.

Nevertheless Muench still takes full advantage of the extensive commercial market for his pictures. He has five agents in the United States alone and his pictures are frequently used in publicity and advertising campaigns. However Muench is also wary of the way in which

David Muench

Dunes, *Death Valley, California*

he uses Tri-X, developing it in D-76 and Dektol and printing his photographs on Seagull paper. Although he prefers Panatomic X, this is unfortunately not made in 4 × 5 format. When he is photographing he does not make any great adjustments for moving from black and white to colour as he considers them to have similar tonal values. He takes the attitude that he shoots black and white pictures on colour film.

Most of Muench's projects involve him in spending a few months in one particular area, but for the book *Colorado* his brief was to show the state at all seasons. He considers it one of his most satisfying projects and spent the best part of a year

Snow covered slopes *in the Bryce Canyon National Park, Utah*

ment. He prefers working alone and, on many trips, as he comments wryly, 'I wouldn't put anyone else through it.' As a result of his intense involvement with his work, Muench has also confined himself almost entirely to photographing within the United States and still feels that he is nowhere near exhausting his subject.

However, his main reason for working alone is his intense involvement with the landscape. He prefers to be totally immersed in his surroundings and work at his own pace. He has also commented that his attitude towards landscape photography can sometimes verge on the obsessional. And it is Muench's search for perfection that has made him a master photographer in his field.

Working in this way has made it a necessity for Muench to work entirely for himself. He rarely accepts assignments. His income is derived essentially from

his pictures may be used. He does not like to encourage land development and hopes that the quality of his pictures will always convey the message that areas of outstanding beauty should be conserved in their natural state.

Even though his photographs are currently very popular, the major criterion for Muench is finally not the marketability of his photographs but his own personal satisfaction in his work. As he says, 'My photography is the expression of a very personal creative urge. There is a deep need in me to work in landscape and I would do it even if the pictures I created didn't sell. I'm fortunate that, right now, they are very popular and lend themselves to being used in a wide variety of ways. But landscape photography has always been a way of life to me. Its commercial aspects haven't changed this at all.'

Pictures from an exhibition

Sergio Dorantes

Most people visit a museum of modern art simply to view the exhibits, but Sergio Dorantes shows that such a place can also make an interesting location for photography

A museum of modern art—wherever it is situated—is usually photographed in order to provide a record of someone else's art, to create slides that accurately depict a famous painting or sculpture. However, the buildings which house such collections are often remarkable in their own right and lend themselves to a personal photographic interpretation—using the shapes and colours of the building and its exhibits as raw material for original photographs.

The images shown here were taken by Sergio Dorantes at the new Museum of Modern Art on the outskirts of Mexico City. He used various lenses and techniques to achieve these results but in all cases he aimed for a highly selective approach and avoided general views of the building or straight record shots of the exhibits. General wide angle views suit certain subjects but in this case Sergio felt that the museum should be photographed so that the details of the modern design could be fully appreciated. For this reason, he concentrated on close-ups of the concrete structure as well as shots that linked the architecture of the building to the innovative designs of the sculptures located around it.

As for the exhibits themselves, Sergio felt that it was particularly challenging to photograph a personal view of them. It seemed rather dull and pointless to shoot straight record shots—you might as well just buy post cards.

To achieve this personal interpretation, Sergio studied the exhibits with great care in order to find the most flattering way to photograph them—perhaps framing one piece of sculpture through another.
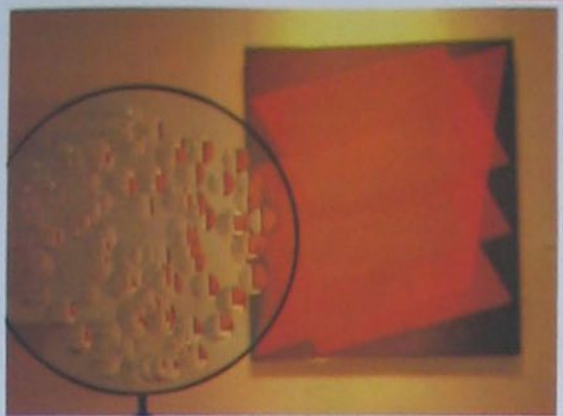
Sculpture silhouette To relate the sculptures to the modern building Sergio used a 20 mm lens, allowing this graphic silhouette to dominate the frame. **Red metalwork** Late afternoon sunlight and slight underexposure achieved maximum impact from the bright red finish. **Concrete beams** In this shot Sergio wanted to show how the modern architectural design harmonizes with the art collection housed inside. **Painting and disc** In order to combine the effect of these two exhibits, Sergio tried two different lenses. He began with the 105 mm but then decided that the shallow depth of his 300 mm lens was more effective—it pulled the two subjects together and enhanced their abstract nature. **Spectators** It is often worth studying the reactions of visitors to a modern art exhibition. **Yellow door** Sergio felt that the warm tungsten light suited this surreal scene. Kodachrome 64 was used for all these shots

Sergio Dorantes

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Large format technique-1

Large format cameras give superb quality images. But using them can be difficult and confusing unless you know exactly what you are doing. However, things can be made much easier if you stick to a few standard procedures

For those used to 35 mm, moving up to large format photography can be quite difficult. The cameras themselves are very different, with none of the 'idiot proofing' that normally prevents double exposures, fogged film, or poor exposure. Film is expensive and the amount you can carry is limited, so that bracketing and 'shooting around' a subject in the normal way is impossible.

And the cameras and lenses are much slower to use. So for these reasons, a disciplined approach and good preparation are necessary, and it is best to adopt set procedures.

The right equipment
With large format cameras you cannot wander around, snapping spontaneously in the same way that you can with miniature models. In fact, before you can even start shooting, you need a fair number of accessories, the first of which is a tripod. Large format cameras are bulky and heavy, and so need solid support. In addition, the lenses tend to be slow, so that slow shutter speeds are common. Although it is possible to hand hold a few types of large format camera, you will normally need a good sturdy support.

It is essential that all the adjustments on the tripod can be locked very securely—not just the head, but also the leg extension, the leg splay (if adjustable) and the centre column. At best, insufficient locking means that you inadvertently move the camera while fiddling with the camera movements or loading the film holder. At worst, a wobbly tripod can mean an expensive crash. Pan and tilt heads are preferable to ball and socket types as they allow you to adjust in one direction at a time. With ball and socket heads, the camera tends to flop around because it is so top heavy.

Another extremely useful accessory for this type of tripod work is a spirit level. This allows you to set the whole camera level, which is invaluable when you are photographing buildings and using camera movements (which are dealt with in a subsequent article). In fact, some of the better cameras have spirit levels built in.

The accessory which most people associate with large format cameras is the dark cloth. This is used to cut down ambient light when viewing the focusing screen, so making the image seem brighter and clearer. It is usually made of black cloth, and you place it over the camera back and your head. Many people seem to associate this procedure with old-fashioned plate cameras, but a dark cloth is an indispensible item even for modern cameras. Some large format models have folding focusing hoods, but these can be expensive. In an emergency, a coat or jacket will do, but a proper cloth with lead weights sewn into the corners is best.

At the other end of the camera, you should use a lens hood. Lenses for large format cameras tend to have little protection against flare, so a hood of some sort is important. The best type is undoubtedly the bellows version which can be adjusted to suit different focal length lenses. Makeshift hoods, using pieces of black card, can also be effective, but make sure that they do not cause cut-off. To do this, check the view on the focusing screen with the lens stopped down.

Once the camera is set up, you need to calculate the exposure, and as no large format cameras have built-in meters as such, this normally means using a standard hand-held type and making allowances for bellows extension. A subsequent article explains this procedure.

Sharp and sensual *The main advantages of large format pictures are very fine detail and a good range of rich tones*

David Fairman

2356
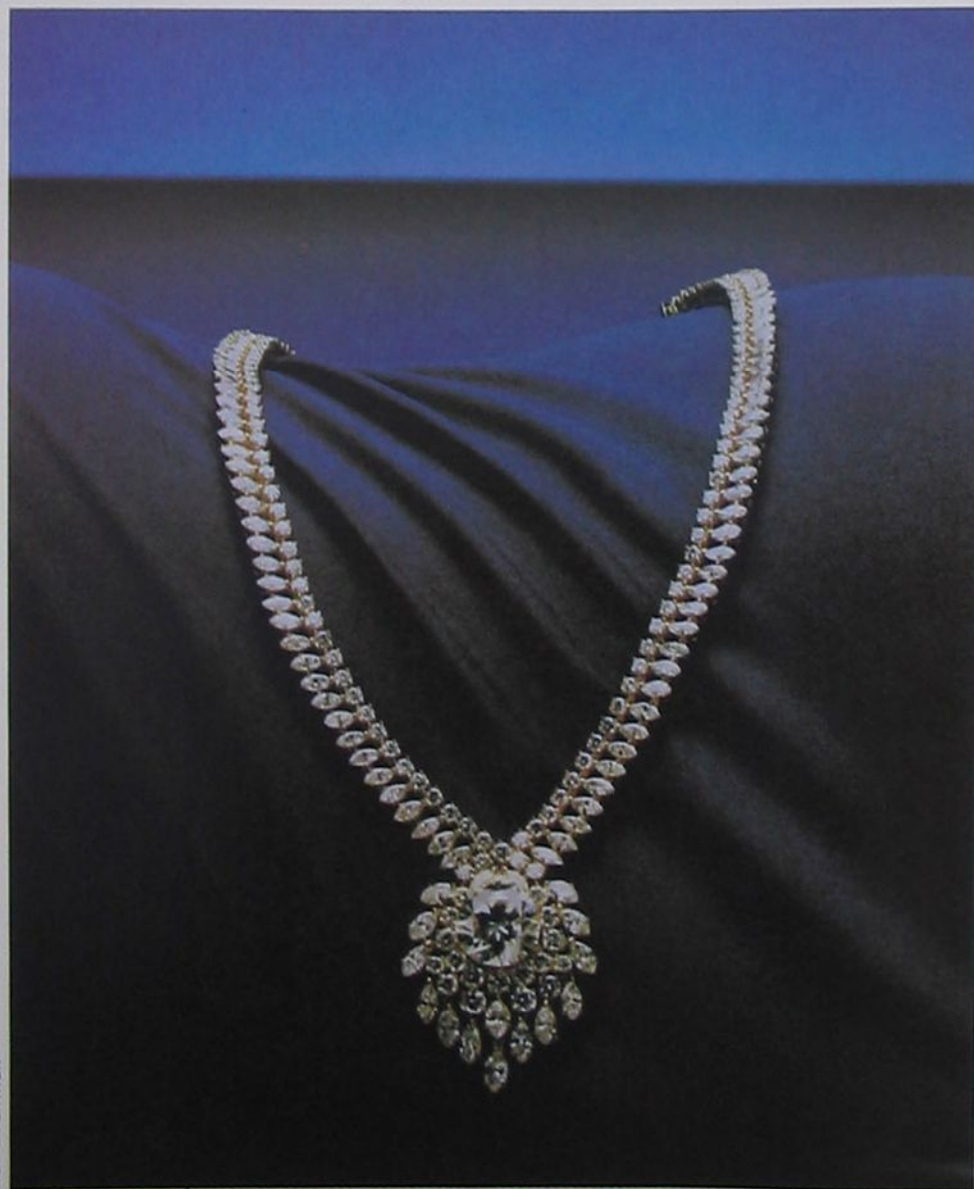
Instant check *Exposures can be difficult to work out, so it is useful to be able to check it using Polaroid film*

For very critical work, however, there are two sophisticated alternatives. One is to use the Minolta III meter with the special probe which allows readings to be taken directly off the ground glass screen. The other method is to use a special meter probe which is inserted into the camera in a similar way to the film holder. Both methods have the advantage that you can meter tiny parts of the subject, and these meters automatically take into account any darkening of the image due to bellows extension.

To make the actual exposure, a cable release is a handy item. The shutter releases on some large format lenses are in awkward places, and it is easy to get your hand in the way of the lens. A cable release avoids this problem as well as giving the usual benefit of avoiding camera shake.

There are a number of other items which are useful, though not essential. The first is a stopwatch for timing long exposures. It is not uncommon to use apertures of $f/64$, $f/90$ or even smaller with these cameras. The lenses are designed to be used well stopped down, and performance at wide apertures is often disappointing. Also, depth of field is frequently very limited even at apertures such as $f/11$ or $f/16$.

In addition, the films available in large sizes tends to be relatively slow—64 ASA (ISO) is most common for colour transparencies. So speeds of around 1/4 second are frequently used, even in bright daylight. When light levels drop, or when you are working indoors, very long speeds are usually needed, and a stopwatch is the best way of timing these accurately.

The other two most useful items are a loupe (see page 1594) and a wax pencil.

The loupe is used to check the focusing on the ground glass screen, and is particularly helpful when the lens is stopped down. The wax pencil is for writing notes on the film holders, to identify the type of film, exposure and so on.

Be prepared

Once you have assembled the necessary equipment, you can prepare to shoot.

This involves making sure the equipment is clean, and loading the darkslides.

Because large bellows soon pick up a lot of dust, they must be kept scrupulously clean. Never leave the back of lens panel off unnecessarily, especially out of doors, as this gives dust a chance to settle. When cleaning the bellows, extend it to its full length and use 'Dust-

Loading the film holder

Before you start, make sure that all dust and grit is removed. When loading in the dark, the flanges under which the film fits

can be difficult to find, so place your fingers at the flange openings to act as guides. The top of the sheath should
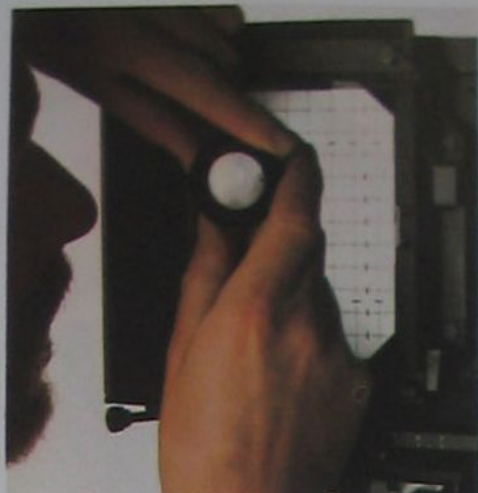
indicate the state of the film in the holder—black for unexposed film, white for exposed sheets

Focusing and shooting

1 *With the lens fully open—using the interrupt or 'T'—focus the image on the screen. A darkcloth is useful here*

2 *After stopping down, check the focus and depth of field with a magnifier. You can then close the lens and cock the shutter*

3 *Carefully insert the darkslide and remove the sheath. You can partly re-insert it or leave it out completely*

Off or a blower brush, or adhesion (with masking tape or better still with a putty-type adhesive compound). Whichever approach you use, clean the bellows very carefully and ensure that removed dust cannot get back in.

As with the camera, the darkslide must be free of dust. If you buy secondhand ones, clean them very carefully before use. Remember, too, that not all second-hand darkslides are entirely light-tight (though one which cannot be used in bright daylight may be suitable for indoor use), and so being able to identify individual holders can be invaluable. The holders should, therefore, be numbered, and most professionals also 'notch' theirs. This involves cutting a distinctive pattern of notches in the lower flap of the holder, so that they show up on the edge of the film—nicks no more than 3 mm deep, made with a small file, are sufficient.

Before loading, make sure that the top part of the sheath (slide) is *dark* side outwards—this reminds you that the film is in the dark and therefore unexposed. Later, when you make the exposure, the sheath should be repaced with the light side outwards, to remind you that the film has been exposed to light.

When you are about to load the film, tap the darkslide smartly on the table to remove any dust which may have settled on it. Once you are used to loading, it is fairly easy. But at first it is worth wasting a sheet of film to practise in the light. You will notice that cut film is notched, so that with the notches on the right-hand side of the top edge the emulsion is facing towards you. Be careful not to get fingerprints on the film.

As each film holder only holds two pieces of film, you obviously cannot carry the same number of exposures as you can for, say, 35 mm. Ten darkslides are about the most you would want to carry. Apart from exercising some self-

restraint, there are two ways around this if you simply must have more exposures. The first is to use a roll film back (see page 1627), and the other is to use a changing bag to reload the darkslides on location.

Changing bags require very careful cleaning if they are not to shed dust all over your carefully cleaned darkslides. Unless you carry plenty of empty film boxes (for loading exposed film into), you also lose the advantage of knowing what is on each film, how it was exposed, how it ought to be developed, and so forth. But if you are to make the most of the large format, and need plenty of exposures, they are the only solution.

Film selection is a personal matter, but remember that you are unlikely to be troubled by grain unless you are using roll film or very small cut film. For black and white work it is common to use reasonably fast film—125 ASA and faster. But for colour the choice is more limited. Typical film speeds are 50 and 100 ASA for colour negative; and 64 and 100 ASA for transparencies (although some 200 ASA professional transparency film is available).

Using the camera

Before you set up the camera to take a picture, spend a few minutes walking about to make sure that you have chosen the best viewpoint. A large format camera on a heavy tripod is very inconvenient to move.

With the camera on the tripod, attach the cable release, and set the shutter to T or use the interrupt (if fitted) which holds the blades open for focusing and composition. Work at maximum aperture for brightness and ease of focusing, but examine the stopped-down effect later, both to see the depth of field and to check the focus, as a few lenses shift focus noticeably on stopping down.

Set the pan and tilt as necessary, and

then lock them—firmly. After focusing, lock that too if you can. Once you are satisfied, make sure that the aperture you want to use is set, and close the shutter. Cock the shutter if necessary, and if you are using T, reset the shutter speed appropriately. With large format work it is usual to decide what aperture you want to use first, and then to set the appropriate shutter speed with the aid of a meter. Do all this gently, so as to minimize the risk of moving the camera.

Equally gently, insert the darkslide or fit the roll film back. Withdraw the sheath completely—you can reinsert it (bright side out with darkslides) after the exposure, or you can partially reinsert it immediately. This not only gives you somewhere clean to put it, but also provides some small additional protection against stray light creeping in. With roll film backs, the standard practice is to wind on immediately after every exposure.

You are now ready to take the picture. Press the release, and immediately reinsert the sheath. Make a note of the subject and exposure (and film-holder number) if you like, then reopen the shutter and open up the diaphragm to make sure that everything is still in focus and still where you want it on the ground glass screen.

Because of the limited number of exposures which you can carry, accurate metering is essential. A Polaroid back is very useful as you can make a test exposure on the spot—but remember to compensate for differences in film speed. The best way to do this is with neutral density filters, as varying the aperture also varies depth of field and there is in any case the danger of forgetting to reset the aperture or shutter speed when returning to conventional film. The procedure for using the Polaroid back varies. With the pack models, you withdraw the sheath as

4 *When you are sure everything is set correctly, fire the shutter, using a cable release to avoid jogging the lens*

5 *Fully replace the sheath (light side out) and remove the darkslide. Open the shutter stop the lens down, and check focus*

those with little contrast can receive the opposite treatment.

Second, there is a form of 'bracketing' which can be very useful indeed. If you take two identical exposures of a subject, at the best possible estimate of an exposure, one can be processed as a test. If it is incorrectly exposed, the other identical exposure can be 'pushed' or 'pulled' to get the result you want. This is especially useful when using expensive colour films, and just two exposures can effectively provide a very wide bracketing range—up to two stops each side of the estimated exposure depending on the type of film used.

While it may seem that there are many things to remember, the most important thing in large format work is to stick to a set sequence. This minimizes the risk of making a mistake such as forgetting to remove the sheath, or leaving the lens open after focusing, and also enables you to work much faster and more confidently as you gain practice. A good idea is to write the sequence on a piece of card and protect it with some clear plastic film. This list can be kept in your camera bag so that you can refer to it on the spot when necessary.

you would on a roll film holder, but with the single-exposure models the film is in a light-tight pack which effectively has its own dark sheath. Whichever type you have, always take the back off the camera before withdrawing the film, or you will probably move the camera.

The fact that each sheet may be processed separately allows the large-format user to exercise two options not open to roll film and 35 mm users. First, development may be extended or reduced with black-and-white film to affect contrast for individual shots—subjects with a long tonal range may be overexposed and underdeveloped, and

Digital click *This is a very advanced (and expensive) unit which greatly simplifies exposure reading and shooting. It includes an electronic shutter, digital meter and a meter probe which reads off the film plane*

Platinum printing

Platinum printing involves coating your own paper with an emulsion derived from one of the Earth's most prized metals—so it is certainly not cheap. But for image quality and permanence it is quite unmatched

Platinum printing is a unique and very attractive way of presenting the best of your black and white work. In the process—which involves coating and exposing home made printing paper—metallic platinum precipitates to form the image. One peculiar characteristic of this image is its extremely wide tonal scale which, even to the inexperienced eye, is much greater than that possible on any conventional black and white print material. This characteristic is much prized by pictorialists; but platinum prints have another valuable attribute—extremely good keeping properties, which can far exceed those of a silver print.

As in calotype printing, the paper is so slow that you cannot print using an enlarger. Instead, you must make a full sized negative for contact prints—and the bigger you make the original negative, the better the quality of the final print will be. This means using a large format plate or view camera to take the original shot, or making a large size duplicate negative from an existing 35 mm or 120 one. This is perhaps most easily made using your enlarger (see page 1121). The best film to use is Kodak Gravure Positive sheet film because of its wide tonal range and clear base—this will give exactly the kind of 'punchy' negative that is needed for platinum printing.

The paper base

Top quality acid-free paper is needed for the print base. Your choice influences the final contrast and the ease with which you can coat the emulsion. A soft absorbent paper gives relatively flat results because the emulsion soaks into the paper and may need several coatings to be effective—whereas the fibres of a sized paper will not absorb as much and the emulsion coatings may be fewer.

Suitable paper can be obtained from graphic arts suppliers, who should be able to advise you in your choice. Hopkinson's paper or Heritage paper are both ideal.

Cut a sheet slightly larger than the negative so you can trim off this handling edge later. Cutting a notch in the top right hand corner helps you identify the emulsion side.

Preparing the emulsion

For the coating stage you need perfectly clean plastic, china or glass (Pyrex) dishes, stir rods and mixing accessories. Metal utensils must not be used or contamination will result. Use disposable polythene gloves to protect your hands and to avoid contamination when mixing and coating.

You need to prepare up to three stock solutions, which are subsequently mixed

Lincoln Cathedral *Although it is quite impossible to do justice to the quality of the image of a platinum print on the printed page, this colour copy from an original does convey some of the beauty of this ancient process*

Frederick H. Evans/T. Herbert Jones Collection
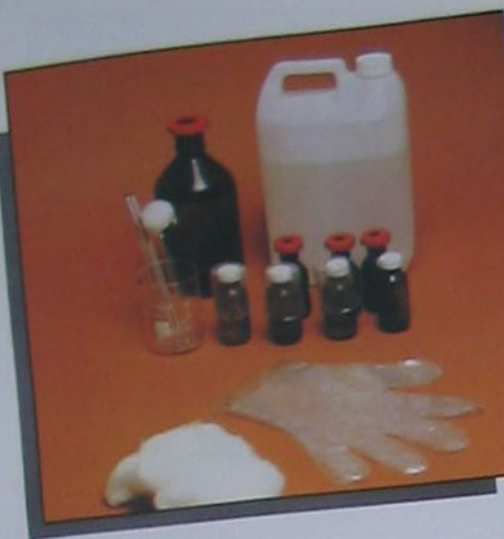
What you need *The chemicals and utensils needed for coating paper with the platinum emulsion. Clean working conditions are essential if you are to avoid waste of the very expensive ingredients*

in one of two ways to form the sensitizing emulsion. Distilled water is used throughout. Mixing and coating can be carried out at room temperature but in amber or red safelighting.

The first stock solution, solution A, is mixed in the proportion of 8 g ferric oxalate to 14 ml distilled water, added to a mixture in the proportion of 0.5 g oxalic acid also to 14 ml distilled water. Solution B consists of 5.2 g potassium chloroplatinite dissolved in 28 ml distilled water. Solution C—which you may not need—is obtained by dissolving 0.15 g potassium chlorate in 28 ml of solution A. The chemicals will dissolve more easily if warmed distilled water is used, but let the solutions cool down before using them. The prepared solutions are light-sensitive and must be stored in suitable containers, such as dark glass bottles.

You can choose from two mixes when you come to prepare the sensitizing emulsion. In the first, 85 ml solution A, 14 ml distilled water and 77 ml of solution B are combined.

The second formula is exactly the same but with the addition of 14 ml of solution C. This second emulsion formula gives higher contrast results than the first.

But by varying the proportion of two of the three solutions used in a three-part mix, other levels of contrast can be obtained. Providing the platinum part—solution B—always forms more than half of the total amount of emulsiom mix (say 55 per cent), solutions A and C can be mixed in varying proportions to make up the remaining quantity. The highest contrast is obtained when solution C predominates over solution A.

Start by using the basic formula, and prepare enough for your immediate needs from the stock solutions. This has to be established by experience but reckon on using one litre of emulsion solution to cover three A4 sized sheets with two coatings.
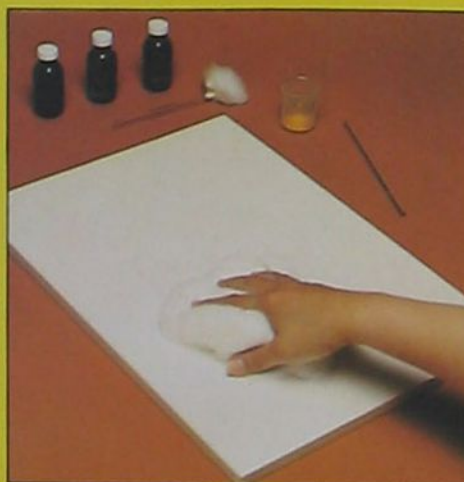
## Coating and exposing a platinum print
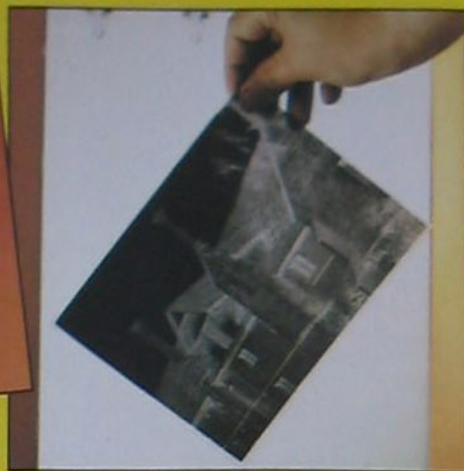
1 *Contact printing methods are used in platinum printing, so the first step is to make a really good quality negative of the appropriate size*


2 *Choose suitable paper and presoak this for about ten minutes in a dish of distilled water. Notch the paper to identify the emulsion side*

3 *Do the coating on a fairly large sheet of thick glass or, as here, on a piece of plastic-faced board. This must be thoroughly cleaned before use*
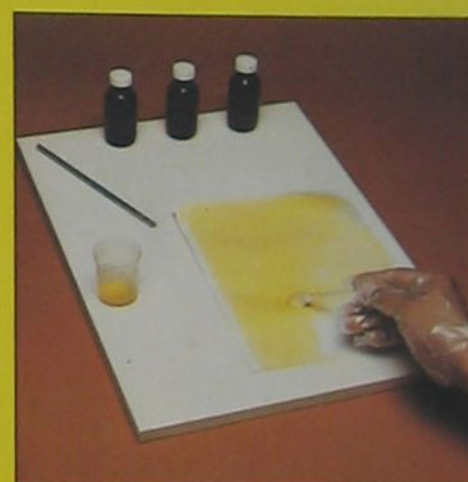
4 *Place the paper on the work board and lightly blot the emulsion side of the paper. Then coat it with the prepared emulsion, using disposable buckle brushes*
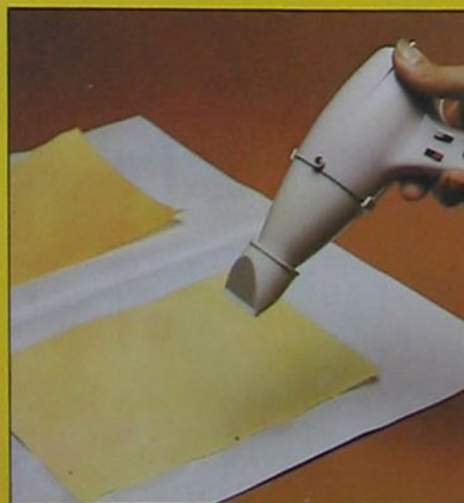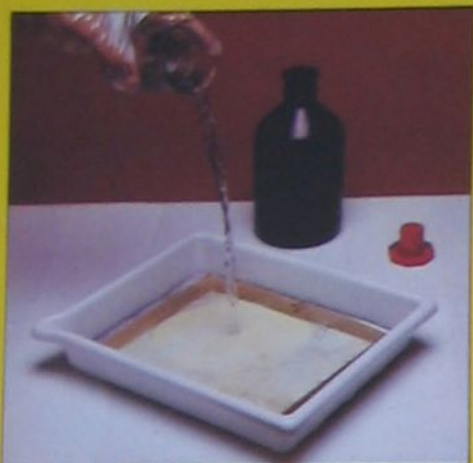

5 *Allow the coated paper to dry in the dark. If necessary, you can accelerate drying with a hairdryer. A second coating can then be given, if required*

6 *Place the negative and paper emulsions together in a suitable contact printer and make the exposure—in strong UV light for between 2½ and 4 minutes—following tests*
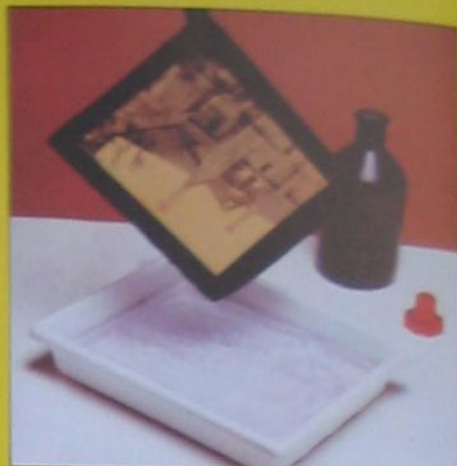
Robert Hurst

Processing a platinum print

1 Place the exposed sheet of paper in a dish and pour the developer over it from above. Development should take place under red or amber safelighting


2 Rock the dish during the course of the two minute development period. The image will come up almost immediately but wait for the full development time to elapse

3 At the end of the development period, carefully drain the print before passing it to the clearing baths. The image at this stage assumes much of its final 'colouring'
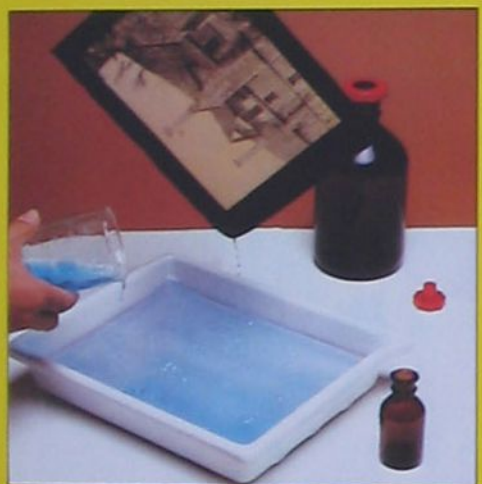
4 If contrast needs boosting, add some copper sulphate solution to the developing agent. You can get a warmer image by increasing developer temperature
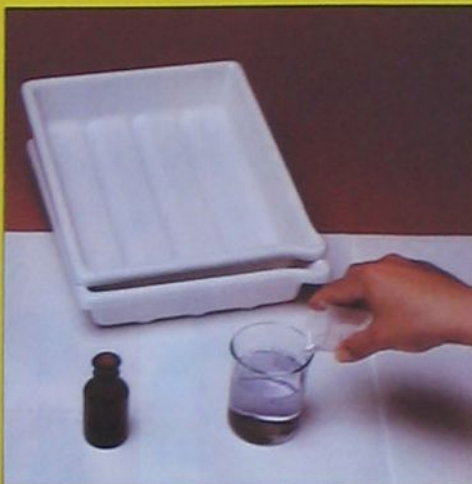
5 The clearing of the print—similar to fixing in conventional printing—is done in three separate baths consisting of a 2% solution of hydrochloric acid

6 Immerse the drained print in the first of the three baths and leave it in this for five minutes, agitating from time to time. Then pass it into the second bath

7 Leave the print in the second bath, again for five minutes before transferring it to the third for the same period. Note that the solution is clear at this point

8 Exhausted clearing baths cause a yellow stain—notice here, the colour of a poorly cleared print (frontmost) and the colour of the clearing baths used

9 Four final wash baths are needed, using distilled water to which a little acetic acid has been added. Tapwater can be used for the second and subsequent baths

Robert Hurst

Paul Joyce/Contrasts Gallery

Group portrait *Three eminent photographers—(from left to right) Bill Brandt, Brassai and Ansel Adams—recorded on a platinum print. Long life is one of the characteristics of a platinum print— so the process is ideal where a permanent record is required*

Lacock Abbey *A modern photo can be given an old fashioned look simply by using old fashioned techniques. Any form of architectural work responds well to platinum printing because of the comparatively large range of tones that can be reproduced on the original print*

Coating the paper

Pre-soak your paper for about ten minutes in distilled water while mixing the emulsion solution. Place the paper on a sheet of clean glass or plastic and remove any excess distilled water from the paper surface with blotting paper.

Then apply the emulsion in a thin, even coating with a buckle brush. This is just a cotton wool pad pushed into the end of a piece of glass tubing (see page 1997). Apply two or three thin coatings of emulsion solution according to the absorbency of the paper, but let each one become touch dry before applying the next. You will find that a thinner negative will require a paper that has a thicker coating of emulsion.

Allow the sensitized paper to dry in darkness. If necessary, drying can be accelerated by using a hairdryer, though you should keep the heat low. But the longer the sheets take to dry, the further into the fibres the emulsion can spread and this gives greater final contrast and density.

You can prepare several sheets in advance and store them in a cool, dry dark place until required. Ideally, the paper should be exposed and developed as soon as possible after coating to avoid any sensitivity drop.

Exposure and development

Prints are made by contact printing the negative and exposing the sandwich to light strong in ultraviolet, such as bright sunlight. However, you my find it better to use a more predictable light source such as a UV or QI lamp held about one

Michael Grey

Landscape *One of the most prized characteristics of platinum printing is the immensely wide tone range it can handle. This enables you to reproduce fine highlight detail as well as the subtle nuances of shadow regions*

metre above your printing frame.

Exposure times will vary according to the negative, the nature of the exposing light, and the characteristics of the coated paper. Therefore, make a series of test exposures at 4, 8 and 12 minutes to begin with. Eight minutes is a typical printing exposure time in bright sunlight. Make a note of the emulsion formula and the corresponding exposure times for future reference. A low contrast emulsion, for instance, will print more quickly than a high contrast emulsion and it may seem confusing if you print the same negative next time using a different formula. Unlike salt printing there will not be an easily visible image so you must wait until the print is developed and dried before assessing the exposure.

Development should be done using solution at room temperature, under amber or red safelighting. It is important to use perfectly clean (ideally new) plastic dishes because these will be uncontaminated. Keep these exclusively for use in platinum printing.

Prepare the developer by dissolving 500 g potassium oxalate in 1.5 litres of distilled water. This is a saturated solution which is reusable and which can be kept indefinitely.

Lay the exposed print on the bottom of the tray and pour the developer solution over it until it is well covered. Rock the dish for two minutes. Although the image

may come up almost immediately you should give the developer long enough to penetrate the depths of the paper before placing it in the clearing bath which follows. This is because the clearing bath tends to bleach some of the detail, and although the effect is subtle it can take out delicate highlight tones in an underdeveloped print. This is one possible way of reducing the contrast, in fact, and a similar effect can be produced by underexposing the print and then using a warmed up developer solution.

Using developer at a higher temperature also makes the image warmer toned. A more controllable way to do this is to add to the developer a few drops of a solution of calcium chloride and copper sulphate dissolved in distilled water, plus oxalic acid at the rate of 20 ml per litre of developer. This will result in an image which is almost sepia coloured if the print is developed at about 75°C. After developing, drain the print and put it directly into the first of three clearing baths. Each of these is a two per cent solution of hydrochloric acid in distilled water. Use three clearing baths in rotation. Immerse the print in each bath for three to five minutes, agitating continuously. The liquid should remain clear and transparent in the last tray, instead of becoming discoloured as in the first. The print must be soaked for no more than fifteen minutes or the image densities will start to be reduced.

The clearing bath serves the same function as a fixer bath in ordinary black and white processing—it removes the unexposed photosensitive salts from the paper fibres. The more efficiently this is

done, the more stable and permanent the image becomes. So after four prints have been put through the first tray, the bath should be discarded and replaced by the second. The second bath replaced by what was originally the third bath, and a fresh bath three is made up.

If yellowed highlights are still present in the print, then the clearing solution is exhausted and needs replacing. The yellowed highlights can be rectified by a further soak in a fresh clearing bath.

Follow this with four final wash baths, each of ten minutes duration. Use four dishfuls of water for this, adding about 10 ml acetic acid to each. Distilled water need only be used for the first. After this, the print can be dried and mounted.

If, after processing, it seems some form of print contrast control is needed, either mix up a slightly different emulsion next time or—if paper has already been prepared—adjust exposure and development.

Placing a handkerchief over the contact frame during printing reduces the light and means a longer exposure is needed—but this will give a higher contrast in the final print.

Another way to increase contrast is to overexpose slightly and then use diluted developer solution. But do not use developer weaker than 1 + 2 or you will get unpleasant grainy effects. For extreme increases in contrast you can add one gram of potassium dichromate for each 500 ml of developer—but be careful not to add too much as this will also result in unpleasant graininess.

Whatever experiments you make, make notes to help cut down wastage of the valuable platinum.

What went wrong?

Rooftops

There are many interesting shots at roof level—an area which people often ignore. But there are problems of composition, as Colin Molyneux points out

I can't really find a great deal to criticize in this picture, try as I might, and I don't think that presented with this subject I would have treated it very differently from the approach chosen. I like the way the horizontal and sloping lines of the roofs and tiles lead the eye naturally to the windows and facade of the house; and even though it is positioned nearly on the edge of the frame, the roof sloping into the picture helps tie the whole thing together. I also like the monochromatic colour relieved by the green shutters. I think I would have tightened up the composition a little, cropping just on the edge of the small chimney and leaving the dormer window on the left of the frame out of the picture. It's in instances like this where the ability to select just the right focal length makes a zoom lens worth any disadvantage it may have in weight and slow speed

Here we have an interesting subject in good light, taken from an unusual angle, all of which should have added up to a striking photograph. The composition has failed to make the most of the possibilities, however. Offsetting the domes to the left of the frame has given the whole picture an unbalanced look. I would have chosen a vertical format for this shot, cropped through the centre of the small dome on the right and the centre of the foreground dome on the left. Although a longer lens would have been necessary to keep the top and bottom of the picture more or less as it is, this would have had the effect of concentrating attention on the two centre domes and emphasizing their shape and dominance over the roofs of the buildings behind. It would also have removed the flat roof on the right which is such a distracting element in the composition

This photograph looks as if it was taken in a hurry. The photographer has seen something interesting and has grabbed a shot without giving much thought to the subject or the reasons for taking the picture. A sure recipe for failure. The point of interest is the tower shaped roof. The way to have emphasized this would have been to use a vertical format instead of a horizontal one, a longer focal length lens and a lower viewpoint to hide the houses behind the subject and isolate the roof against the sky. Finally, better light would not have gone amiss. This approach would have concentrated the viewer's attention on the roof and portrayed the subject as a strong graphic shape, which it is. When it comes to taking good photographs a little thought and a lot of patience are more important than a vast array of equipment. Equipment just makes things easier

In this picture of rooftops, I am not sure what the photographer was trying to capture. There are too many conflicting elements without one being dominant enough to stand on its own. A more selective approach would have been better. What you leave out of a picture is as important to the final result as what you actually show. A vertical format, for example, would have concentrated attention on the white building. Framing the picture to include the bottom of the windows, the roof, chimneys and part of the sky would have produced a stronger photograph. There is a lot of contrast in this scene which has created areas with little or no detail in them. If the picture had been taken when there was a little more light in the sky the contrast between the building and the roof would have been less, allowing more of the detail to show. This, I think, would have made for a more interesting shot

Photo-etching

Copper plates for printing ink images of your pictures can be made by a simple photographic process—'photo-etching'. And with an etched copperplate, you can print a whole range of stunning artworks, either singly or in large numbers

Pauline Gentry

Some of the most interesting and versatile of all photo reproduction techniques are those used in the printing world. Once you can produce a line image quickly and confidently, you can begin to explore the possibilities of these techniques yourself and one of the most interesting is *photo-etching*.

Photo-etching essentially involves photographically transferring an image to a metal plate, etching away appropriate areas with acid, and using the

Artistic effects *Colourful and dramatic effects can be produced by skilful manipulation of photo-etching techniques*

etched plate to print ink on to paper. The etched plate can be used just once to make a single print, or again and again to make numerous copies. Indeed, you can use the process simply to produce the etched plate to use as a decorative plaque or a nameplate.

Any photograph can be used to make

a photo-etch print, though simple images are far more suitable. But they must be converted into a suitable form before they can be used for making the plate.

If you are content with a simple line image, you can make a copy from the negative or slide on lith film (see pages 914 to 917). If you want to retain the full tonal range of the picture, however, you must use the dot pattern of a halftone screen (see pages 1128 to 1129) to convert the tones into appropriate sized dots. Halftone images can be made by exposing lith film through a halftone *contact screen*. Alternatively, you can use a special orthochromatic film called *autoscreen* which incorporates its own halftone screen pattern. Making and using halftone images is explained fully in a subsequent article (see pages 2414 to 2417).

When making the line or halftone image, it is important to remember that it is used to produce the plate by contact printing. So the print will be exactly the same size as the line or halftone image. If you want a large print, then, you must make a large line or halftone.

Relief or intaglio

The printing plates can be etched in one of two ways: *relief* and *intaglio*. These can be used either separately or in combination.

To photo etch in relief, you must work from a line or halftone negative. The plate is coated with a light sensitive emulsion and during exposure to a blue light source, the printed areas form an *acid resist* coating which is, in effect, a photostencil that protects the metal below from the etching solution. It is during the etching period that these areas are left in relief as the original top surface of the plate. When the print is inked, the raised areas print the positive image. Relief prints give strong, direct lines. Colours are rich, particularly in large solid areas. Photo-etched prints can produce attractive fine line detail when printed well. In photomechanical reproduction this process is referred to as *letterpress* printing.

Intaglio photo-etching is the reverse of relief, and is produced from a positive image. During exposure, the non printing area forms an acid resist area. The image is etched below the top surface of the metal, the darkest tone being the deepest. A characteristic of intaglio printing is the plate edge. It depresses the printed sheet and produces a very attractive 'frame' around the image. The most common example of this photomechanical reproduction method is *photogravure*, well known for the superb tonal image quality that can be obtained.

Preparing the plate

You can use one of a variety of metals for the printing plate. The two most popular are zinc and copper. Zinc is relatively cheap and is widely available. Unfortunately, it is more brittle in use than copper and can deteriorate under

Etching the plate

1 *Essential equipment: smooth copper plate, Kodak Photo Resist and developer, acid, bitumen, lamp, brushes, swabs, rubber gloves and cleaning materials*

2 *Fine surface scratches can be removed with white spirit and hard charcoal. Wipe over with ordinary metal polish and polish to a high shine*

3 *Clean the plate again with a solution of 3 per cent caustic soda mixed with chalk powder to make a paste. Wash it off with weak acetic acid and wipe dry*

7 *Exposure is largely trial-and-error, but try exposing the plate with a QI movie light or UV lamp for about five minutes at a distance of about one metre*

8 *Agitate the plate in a dish of resist developer for five minutes. Then wash it under cold water until the image appears. The developer can be kept for future use*

9 *Make sure that the plate is completely dry, then paint out the back with bitumen or any similar acid resistant substance—you may want to use it for etching later*

pressure. Copper is more expensive yet it has many advantages. The etch is slow and accurate, giving better image control and good printing qualities, and is much more suitable.

Copper can be bought from a builder's merchant specializing in high grade roofing copper, similar to that used on church spires. You can expect to pay about the price of a roll of black and white film for a sheet of 20 × 30 cm. Carefully select a piece without any surface marks or deep scratches. Fine surface scratches can be removed by rubbing gently with white spirit and hard charcoal—both are available from artist's suppliers. Then wipe over the selected surface with an ordinary metal polish, dry it off, and polish the plate to a high shine using soft tissue paper. Handle the plate by its edges as fingerprints can leave grease on the polished surface.

Next, clean the plate with a solution of three per cent caustic soda and add some French chalk to form a thick paste—though ordinary caustic oven cleaner is a good substitute. Finally, wash the plate with a solution of salt and vinegar (or acetic acid) and wipe it dry with clean tissue. The copper surface is now chemically clean. All these solutions can be prepared and used in ordinary plastic developing dishes.

Coating

Plate coating must always be carried out in yellow safelighting, as used for printing black and white bromide prints. Although the speed of the dried coating is very slow when compared to ordinary photographic films, it is blue light sensitive and can be fogged by even poor daylight. It is also important to coat plates in a carefully selected dust free working area. Any dust which settles on the coating during drying will spoil the final printing image.

Use Kodak Photo Resist (KPR) for coating. The complete kit consists of three solutions—the resist, the resist developer and resist dye. Hold the plate on splayed fingers of one hand, and pour the minimum of resist on to the plate centre with the other. Roll your hand from the wrist, allowing the coating to flow evenly over the whole area of the plate. Then stand the plate on edge, support it against a wall and let the resist drain into a dish. Any surplus resist can be returned to the bottle for future use. Either leave the plate to dry naturally, or use a hairdryer—at a safe distance—to speed up drying.

Exposure

When the plate is thoroughly dry, lay it emulsion up on a piece of foam rubber. Select your prepared negative or positive—negative for relief or positive for intaglio—and lay it emulsion down upon the dry plate, completing the sandwich with an oversized piece of plate or float glass. As you look at the image, it should be reversed. Using a QI movie light or UV lamp, make a trial exposure of the plate for about five minutes, at a distance of about a metre. You will need to experiment a little, however, to find the correct exposure.

Pour a quantity of resist developer into a dish and slide the exposed plate beneath the top surface of the solution. Agitate the plate, allow it to develop for

4 *The plate must be coated in a dust free working area under proper safelighting—KPR is sensitive to blue light and can be fogged even by weak daylight*

5 *Hold the plate on splayed fingers of one hand. Pour resist onto the middle of the plate and roll out evenly. Drain off any surplus and dry with a hairdryer*

6 *Lay your positive or negative on the plate, emulsion down. Complete the sandwich with a sheet of float glass. Note the masks to preserve borders*

10 *Use acid resist to block out any areas you do not want to etch. Masked areas will subsequently print out as block colour in relief printing and as black in intaglio*

11 *After preparing the ferric chloride solution, pour it into a dish much larger than the plate. Lay the plate in the dish and gently swab it with the solution*

12 *After ten minutes, remove the plate and force spray it with tap water. Then lay it on a folded newspaper and swab with developer to remove all the coating*

five minutes, remove it from the dish and wash it with cold water, until the image appears. Pour the developer back into the bottle for future use.

The etching stage
Make sure that the plate is completely dry and then paint out the back of the plate with bitumen or any similar acid resist which is available from your local hardware shop. This is to protect the rear of the plate, leaving it clear for future use in a re-run, possibly with a different image. When the back is completely dry, work on the front to remove any blemishes using the cleaning routine previously outlined. At this point you can mask with acid resist to block out areas you do not want to etch—if, for example, you wish to use one side of the plate to print multiple images. Masked areas subsequently left unetched will print as block colour in relief printing, or as black areas in intaglio.

A ferric chloride solution is ideal for etching. It is good for very 'fine biting' of copper and is slow working. The appropriate strength for normal etch solution can be made by mixing 80 g ferric chloride in a half litre of water. Add approximately three drops of concentrated washing-up liquid to each half a litre of the solution to act as wetting agent. Wear rubber gloves to protect your hands when mixing and using the etch solution.

Select a plastic developing dish that is much larger than your plate, and support the back so that it tilts towards you. Pour a quantity of ferric chloride into the front part of the dish. Lay the plate in the dish, exposed side up, and gently bathe the plate with solution, using a cotton wool swab. Keep repeating this action from the top to the bottom of the plate, replenishing the ferric if necessary. After ten minutes, remove the plate and force spray it with tap water. Lay the plate on a folded sheet of newspaper and, using a cotton wool swab soaked in KPR developer, remove all the coating.

Aquatint
Where there are large solid printing areas in your etched plate, you can improve printing quality by spraying it with a tint from a pressurized can of car lacquer. First paint out all the etched areas with bitumen. When the bitumen dries, spray the lacquer upwards over the areas, so that it falls in a mist. When dry, it forms an acid resist spatter which you can re-etch. Etch for a short time to produce a light colour when printed. The longer you etch, the darker the tint.

Printing
To print, cut and prepare sufficient paper for the full run. Although most types of paper can be used, bear in mind the effect that its texture, thickness, finish and base colour may have on the final image. During printing the paper must expand over the complete plate surface. It is forced into the fine lines and printing areas and must not distort or crease. For printing, the paper is first soaked in a dish of cold water where the fibres soften and the paper becomes pliable. It can then conform to the shape of the plate without tearing.

The soaking time depends upon the paper weight. Soaking time can be a matter of minutes or hours. Thicker

Making the print

1 *To make a print, you will need a mangle, special printing inks (or pigment and copperplate oil to make your own), a palette knife, paper and rubber gloves*

2 *First, cut and prepare sufficient paper for your printing run. Soak it in cold water until it becomes pliable. Then lay it between sheets of blotting paper to dry*

3 *Force the ink into the intaglio of the cleaned and warmed plate with a small piece of soft felt rolled up and taped to form a swab. Use a dabbing action*

4 *As the plate gets colder it becomes harder to drag ink out of the intaglio. If necessary rewarm the plate over an electric hob, set low, to keep ink fluid*

5 *Carefully wipe the ink away from the top surface with a piece of soft muslin or scrim. This is available from the soft fabrics department of a general store*
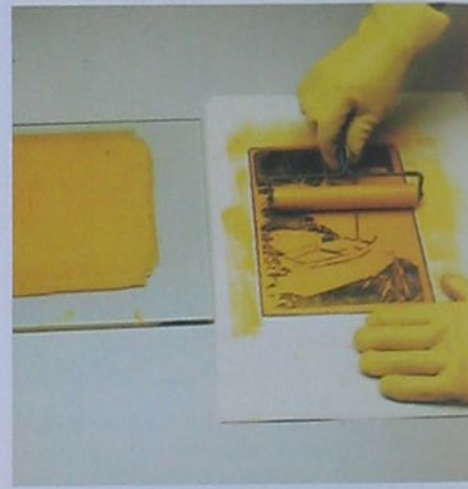
6 *Two colour prints can be made by using one plate for both relief and intaglio printing. Once the intaglio is filled, ink the relief areas with a hard roller*

7 *Nip the inked plate between the rollers of your mangle. Then back the paper with a sheet of felt and feed the leading edge into the nip with paper facing plate*
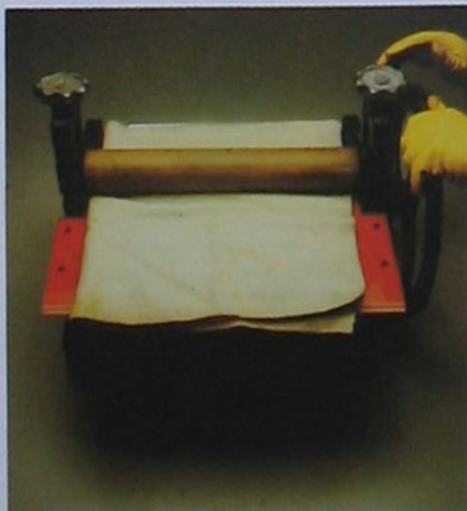
8 *Wind the handle so the plate, paper and backing blanket feed through the rollers slowly and continuously. But do not let paper and plate touch until the nip*
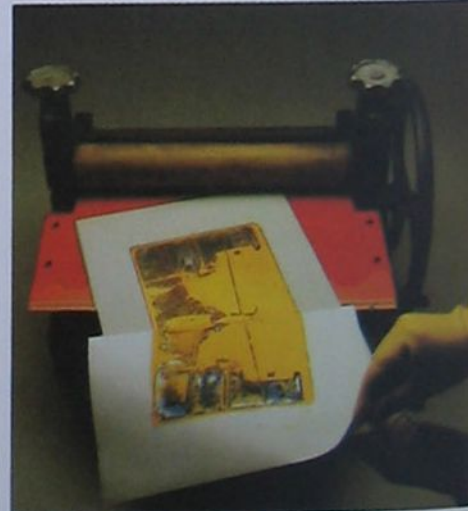
9 *When the sandwich has passed through the mangle, remove the blanket, pick up one edge of the paper and carefully separate it from the plate in one movement*

sheets are soaked much longer than those of lesser weight. You must find the best time by trial and error, but start by soaking for one hour. Then remove the paper from the water and lay it between sheets of blotting paper until it is nearly dry.

You can buy the special printing inks from a printer's supply house or some graphic arts suppliers. Ink for intaglio is known as *copperplate printing ink*. You can also buy black or coloured pigment powder and *copperplate oil* and make your own ink. This gives you better control over its consistency. The oils can be bought in grades of heavy, medium and light. Try to make the ink thick enough to remain in the printing areas without being dragged out. But it must not be so thick that you cannot easily wipe clean the non-printing areas of the plate.

When mixing with a palette knife, lift the knife out of your mixed ink. If it just drops off the knife, then the consistency is correct. A thick ink is ideal for aquatints with a shallow printing surface. Where the etch is deeper, then use a thinner ink. Wear rubber or disposable polythene gloves when mixing and applying ink.

To make the print, the plate is inked and then brought firmly into contact with the paper. Ideally, a professional proofing press should be used and you may be able to get access to one in a college or studio. An alternative is to buy an old clothes mangle with rubber rollers, preferably with some degree of pressure adjustment. The mangle should be clamped firmly to the work table.

Start the inking sequence first by cleaning and polishing the plate, with metal polish. Remove any accumulations in the etched recesses—the intaglio. Heat the plate on a dishwarmer or electric cooker hob set on very low heat. When it is quite warm remove it from the hotplate. Roll up a small piece of soft felt and tape it to form a swab. Also cut a piece of felt slightly larger in area than the paper image area. Dab the ink on to the plate, forcing it right into the intaglio. Using soft muslin or scrim—available from the soft fabrics department of a general store—carefully wipe the ink away from the top surface of the plate in a circular polishing motion. As the plate gets colder the ink becomes harder to drag out of the intaglio—but be careful not to overwipe.

Take the inked plate to your mangle and nip it between the rollers. Back the paper with a sheet of felt—the *backing blanket*. Feed the paper and backing into the rollers—the paper facing the plate. Hold up the other end to keep the paper clear of the inked plate.

Wind the handle so the plate, paper and backing blanket feed through the rollers slowly and continuously. Do not let the paper or plate touch until they meet at the nip of the rollers. When the sandwich has passed through the mangle, remove the blanket, lay the plate on the table, pick up one edge of

the paper and carefully separate it from the plate in one movement. Repeat the process for further prints. Hang the prints on a line until both the ink and paper are dry.

Interesting two colour prints can be made by using one plate for both intaglio and relief printing. First ink up the plate in one colour using the felt dabber—this will fill the intaglio. Then use a hard rubber inking roller to ink up the relief areas with a second colour. The plate can then be printed as before.

Multicolour printing

Once you become familiar with single and two colour printwork, you can begin to experiment with multi-coloured images, using posterization, Sabattier effect and montages as starting points. Indeed you can make full colour prints by making separation negatives and then printing yellow, magenta and cyan images in register.

But before trying anything ambitious, try simply printing three colours in register, starting with three positive separations as a posterization. Then cut three copper plates to the same size as the film sheets. Make an etch plate from each of the separations in the usual fashion to give you one plate for printing each of the three colours. The big problem is printing them in register.

Select a piece of strong cardboard, larger than your plate and printing paper. Cut and dampen your printing sheets and ink up all the plates. Stick the
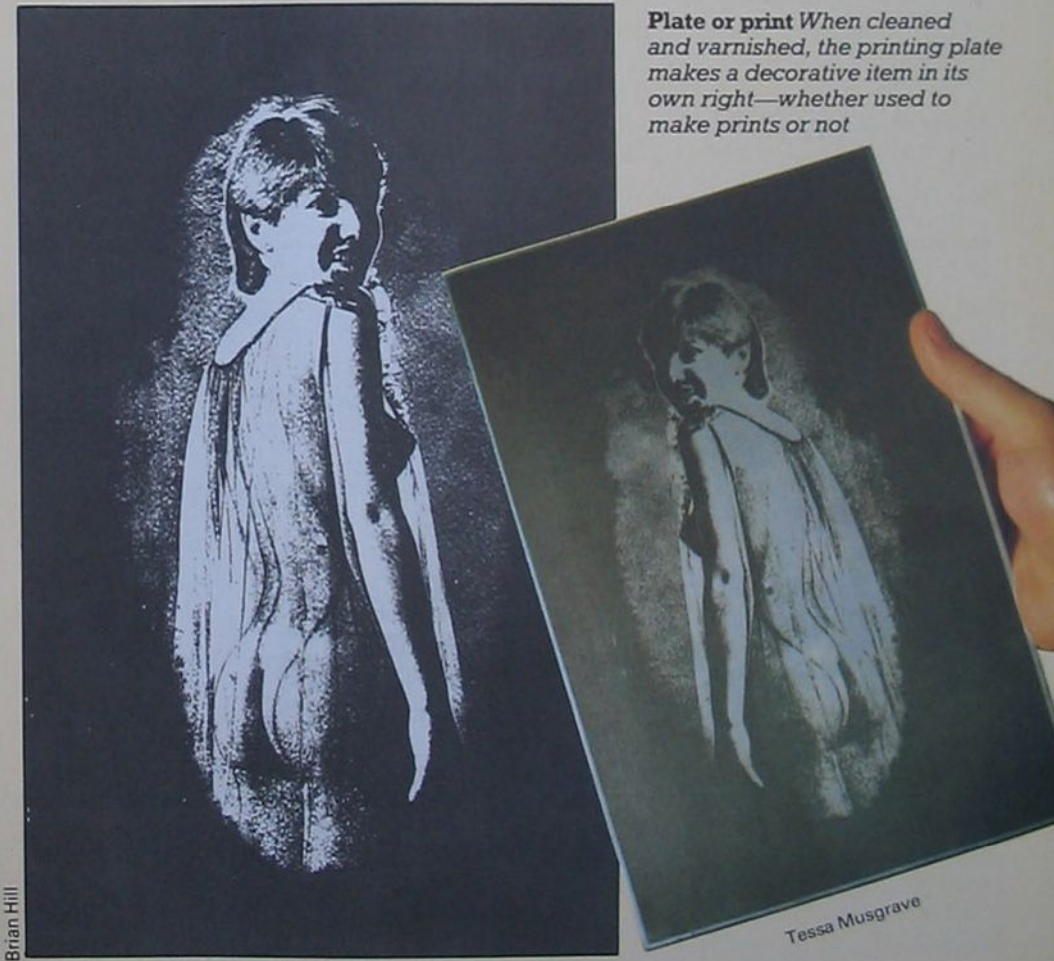
first plate to the card with double-sided tape. The first colour to print is the lightest colour. Lay one sheet of paper over the plate, but not touching, and tape it with masking tape along the leading edge. Lay a blanket over the paper. Feed the edge of the cardboard into the roller nip and pass the sandwich through your mangle. Place the card on the table, peel back the printed sheet and, before removing the plate, draw an accurate pencil line around it on to the card. Remove the plate, place the second plate exactly within the drawn rectangle. Print this as before, then repeat with the third colour.

Embossing

Make a relief printing plate, working from a negative. Keep the image simple and bold—close-ups and strong silhouettes (such as trees) are ideal. Prepare the plate as intaglio but use a stronger etch solution to etch it much deeper. Soak your paper and clean but do not ink the plate. Pass the sandwich of paper and plate, with a double thickness blanket, through your mangle. The fibres of the paper will be distorted in the relief form of your image—similar, in principle, to an embossed letterhead.

When you have completed printing, ink up the plate again and let the ink completely dry in. Polish the metal surface carefully and preserve the copper plate by spray or brush varnishing. When framed, your plate becomes an attractive picture in itself.

Brian Hill

Tessa Musgrave

Plate or print *When cleaned and varnished, the printing plate makes a decorative item in its own right—whether used to make prints or not*

Camera construction

Cameras have come a long way since the days when they were all polished wood and brass and the light, compact and durable cameras of today owe much to the incorporation of a variety of new materials, from special alloys to plastic

A modern camera is constructed from an astonishing variety of materials. Some of them, such as brass, have been in use since the very beginning of photography, while others, some of the new plastics for instance, are the result of the very latest technological developments.

It is the job of the camera designer to select the right material for each particular camera function—but there is more to this than meets the eye. Not only must the material do what it is supposed to, it must also have the right cost and 'market appeal', especially when it involves the external finish. Some materials and finishes both look and feel nicer to the camera-buyer even though, from a structural point of view, a cheaper but less attractive material might do the job just as well.

Inside the camera, the choice of the right material is no less complicated, as the different functions of the various parts of the camera require different materials.

Body materials

The basis of the camera is the chassis. This must be tough, rigid, corrosion-resistant and capable of being worked to a high degree of precision. While the stainless steel body of the Robot camera (see page 1746) meets all these needs, it is also extremely expensive and difficult to work with, as well as being very heavy. The chassis of the pre-war Leicas, however, was thin brass sheet, which is reasonably cheap and light, but it is time-consuming work to shape it precisely and although it is reasonably resistant to corrosion, it is not very rigid.

A light alloy, however, does meet the requirements for rigidity and durability, as well as for lightness, and this was the solution chosen for the famous Contax camera right from the start and then, after 1940, for the Leica too. Today almost all cameras in all formats have alloy bodies. The only serious drawback of alloy is that it is relatively soft and tends to wear quickly, so that steel spindles cannot run directly into it, but must be bushed. Most of the better cameras use alloys including copper,

aluminium and silicon, though others use magnesium alloys for lightness, or even zinc alloys for cheapness. The Nikon F2 Titan used titanium, which is extremely light and strong but very expensive and difficult to work, and is actually much

stronger than is strictly necessary.

Though there may be a single chassis casting, it is not unusual to use two or even more: the Contax IIa and IIIa sported four major die castings. An interesting recent development,

Fashioned in teak, *this splendid 5 × 4 inch format camera becomes fully functional once the protective front plate is removed and a conventional lens fitted*

Colin Glanfield/camera courtesy of John Jenkins

Thin, alloy, die castings *of a 1950s Leica 111f shutter crate assembly are revealed by stripping away the decorative blackening*

demonstrated in the Nikon EM, is the use of a light alloy 'skeleton' where dimensions and rigidity are critical, together with a moulded-on plastic underbody to flesh it out. This makes for an extremely light and strong form of construction that could well be used more and more in producing high-quality, low-cost cameras.

Bolted directly to the chassis is the lens mount, which must withstand the wear and tear of lens changing. Hard stainless steel is favoured for many professional cameras, though plated brass or steel is more usual on less expensive models.

The function of the outer casing is to protect the delicate inner mechanisms of the camera from blows, dirt and moisture. Pressed plated brass is the traditional method: it is reasonably cheap, quite strong enough unless made far too thin, but rather heavy. For this reason it has been supplanted to a certain extent by plastics, which can give just as much protection, are lighter, and can be formed very much more cheaply. It is difficult to make plastic sufficiently thin and rigid for the camera

back, though, and this remains a pressing of brass, steel, or light alloy.

Plastics

Though the incorporation of plastics in camera construction is commonplace, there is still a strong prejudice among photographers against its obvious use and some manufacturers have had to develop extremely clever metal-coating techniques to disguise the material underneath.

This prejudice is not completely justified. Though plastic cannot be used where dimensional stability is important—in the chassis casting for example —it is better than metal at absorbing blows and bumps, and it does not dent. It
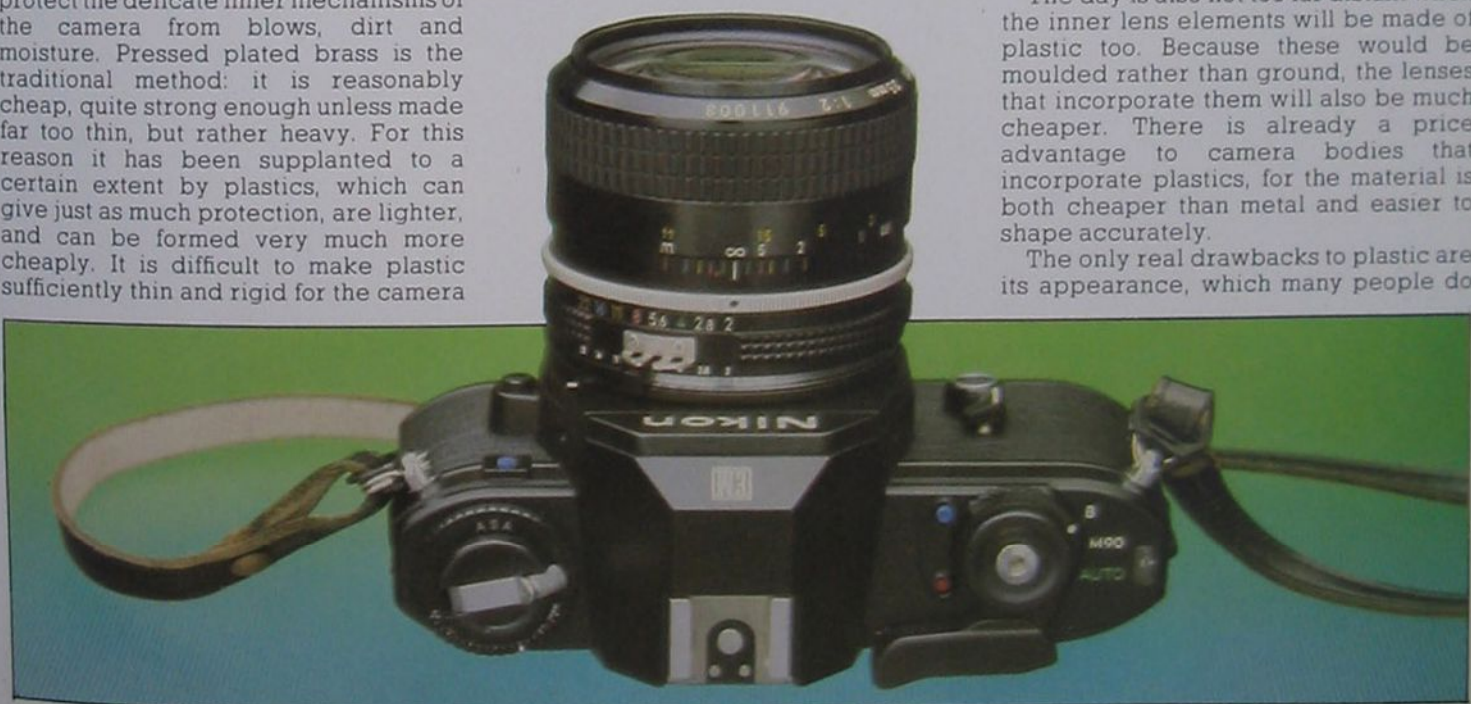
Lightness and strength *are achieved in the modern Nikon EM, which employs a light alloy 'skeleton' fleshed out by a low cost moulded-on plastic underbody*

Folded brass sheet *shutter crate of a 1932 Leica 11, with blackening removed. Folding brass requires great skill, and the result is less rigid than a casting*
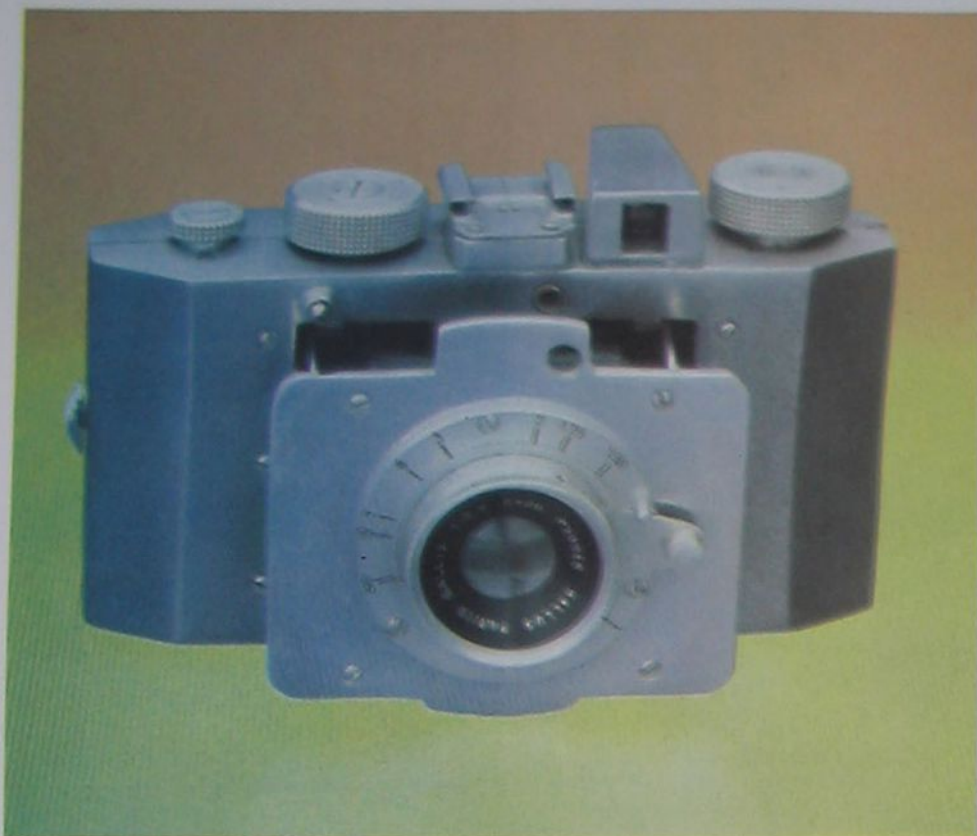
is also much lighter, as a comparison between an old all-metal camera and a new, part-metal, part-plastic one shows. The redoubtable Canon FTb weighed a hefty 750 g altogether whereas its modern counterpart, the AT1, weighs only 590 g, a reduction of over 20 per cent.

Much the same is true for lenses, where plastic barrels have begun to replace metal ones. A Canon 28 mm f/2.8 SC of a few years ago weighed 280 g, against the 170 g of the modern version. Extend these differences over a whole camera-bag full of gear and the advantage of plastic to the active photographer is obvious.

The day is also not too far distant when the inner lens elements will be made of plastic too. Because these would be moulded rather than ground, the lenses that incorporate them will also be much cheaper. There is already a price advantage to camera bodies that incorporate plastics, for the material is both cheaper than metal and easier to shape accurately.

The only real drawbacks to plastic are its appearance, which many people do

and thumb-pads are a matter of taste.

Although electronics and electrical components are playing an increasingly important part in photography, they can normally be fitted around the existing camera frame. There is no need to alter the familiar 35 mm SLR shape to accommodate the tiny circuits required for automatic exposure systems or electronically controlled shutter mechanisms. Once the designer has decided the size and function of the circuits, the construction of the electronics can be left to an electronics expert.

Finishes

A finish not only makes the camera look good: it also protects it. Wood is usually polished and waxed, though normally plastic need be refinished only to disguise it. For metal parts, there is no doubt that well-executed chromium plating offers the best protection, but the silvery finish is now unfashionable, and only Leitz seem to have mastered black chrome. Anodizing has its uses, and is widely favoured for lens mounts, while a few cameras simply use polished metal —which dulls very quickly.

No paint can be as durable as plating, but modern electrostatic deposition and paint technology does give a very much

not care for, and the fact that it can feel rather slippery if one's hands are at all greasy or moist.

Mechanisms

The film transport gears must be strong, smooth, and tough: phosphor bronze is ideal, though brass and steel are cheaper and easier to work, and steel is stronger. All three materials are used, though the bronze is usually reserved for top-flight cameras. Shutter gears are usually subject to much lower stresses, so brass and steel are perfectly suitable. In some positions, hardened steel is the preferred material, as it is extremely strong and rigid, while if properly used its brittleness is no disadvantage. The spindles and revolving shafts are best made of tough, cheap steel.

In a few low-stress applications, plastic and even die-cast gears are found; typical uses are in metering mechanisms, or in other places where heavy wear is not expected. As well as being cheap to make, plastic gears can be very smooth and quiet; if the right plastic is used, and the mating surfaces are sufficiently large, they may even replace metal gears in more demanding situations. For the leaves of a between-lens shutter or the blinds of a focal-plane type, a very light but very strong material is needed: very thin steel (sometimes stainless) is the favourite, though titanium is used increasingly.

The controls should be easy to grip and quite strong—they are, after all, the parts most likely to be damaged by careless handling. Metal can be knurled or rigid to give a very good grip: die-cast light alloy is usually strong enough, though brass is even better. Plastic tips

Cast alloy body of a 1950s Gallus. The camera is fitted with a 50 mm f/3.5 Tessar type lens and gives 16 exposures on a roll of standard 127 film

Hasselblad use polished alloy finish to good effect. This type of finish is not fashionable, but it is functional and hard-wearing for professional cameras

Courtesy of E. Leitz Ltd.
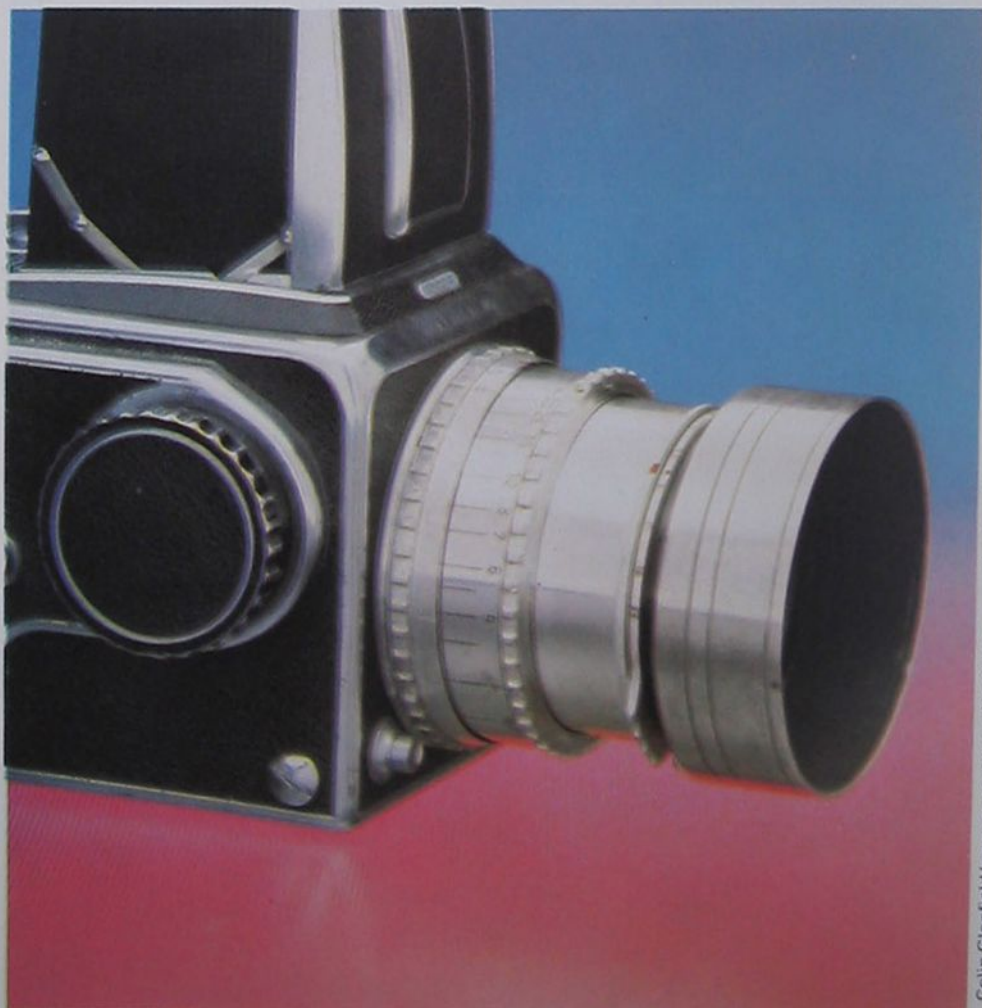
A partly sectioned Leica *reveals the large number of components, as well as the many different types of material that comprise a modern camera. Some cameras could be assembled from components made at a single factory, but it is more usual (as at the Leitz works, below) to buy in certain specialist components*

tougher finish than the old black enamels. Eventually the paint wears, and shows the brass underneath, but this effect is much prized by some people—showing clearly that their camera has been heavily used. Stove enamelling lasts well, though it is more used on large format than on miniature cameras: it certainly lasts much better than its rival, black wrinkle paint. The least durable finish is clear lacquer, used over chrome, brass, and anodizing.

Body covers such as leather, rubber composition, or synthetics give a better grip than plain or painted metal or plastic, as well as being warmer and more pleasant to touch. Real leather feels best, but its moisture content can promote corrosion. Natural or synthetic rubber composition covers probably give the best grip, though too obvious and regular a pattern may meet consumer resistance as being too unlike 'real leather'.

With such a choice of materials, finishes and customer prejudices, it may seem that the designer has a hard time. This is true. The art of camera construction is a constant struggle to build a precision instrument that is as hard-wearing as possible at a price the photographer can afford, and which will also have that elusive quality of feeling right in the photographer's hands.

Courtesy of E. Leitz Wetzlar Gmbh

Jay Maisel

World of photography
Jay Maisel

An intense enthusiasm for the qualities of colour and light and the ability to capture them on film have made Jay Maisel one of the most sought-after photographers in New York

Jay Maisel is one of the United States' most flamboyant photographers. He is often to be seen striding around his native New York wearing Nikons like other people wear amulets—frequently with a large cigar protruding aggressively from his mouth. If he sees a good shot he is likely to stop his car right in the middle of a busy New York thoroughfare to capture it, or climb to a precarious position on scaffolding for the right angle on his subject.

In contrast to his extrovert personality, Maisel's pictures reveal quieter and more reflective, if no less exuberant, concerns. They show an enthusiasm for the purity of colour and light—often in its most romantic and lyrical aspect. Some of his characteristic images include light glinting on telegraph wires in the early morning, the afternoon sun reflected on the nape of a woman's neck as she waits in a taxi, an enlarged moon balanced precariously between the twin towers of

Salvador, 1977 *One of a series of personal pictures that Maisel took in Brazil to accompany a record of Bahian songs*

Golden Gate Bridge *A superb early morning shot taken for Maisel's book on San Francisco for the publishers Time/Life*

the World Trade Centre and the subtle bands of muted colour created across a landscape on a misty morning.

All these images occur repeatedly in life but by translating them on to film with his expert eye for colour and composition, Maisel makes us notice them as if for the first time. In his constant search to present the lyrical aspects of life in a fresh and original way he can continually present an old and clichéed subject from a new and breathtaking viewpoint. He has, above all, a painter's eye for seeing colour, line and form, but prefers to express himself on film rather than canvas.
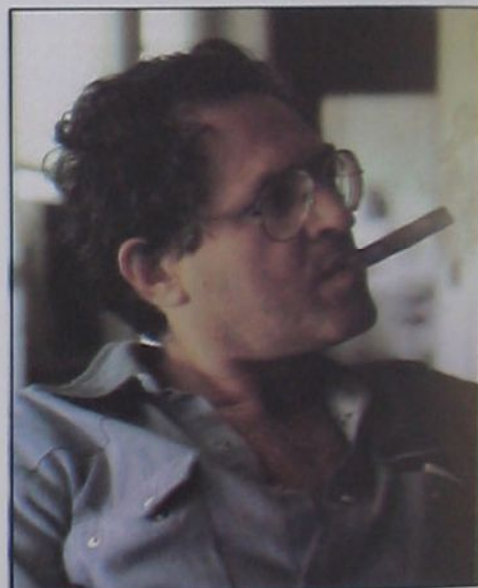
Angela Murphy

One of the major influences on Maisel's career was his initial decision to be not a photographer, but a painter. As a young man, his overriding interest was painting. And to this end he attended art school in New York. But although fascinated by the elements of colour and form, he discovered in the end that painting was not the right medium for him.

Towards the end of his time at art school he started taking photographs for the architect Buckminster Fuller, and in his last year gradually became more interested. With the aid of a camera he found he could create beautiful pictures

instantaneously. 'Photography was really good for me because I'm really involved in instant gratification. Painting was very tortuous. You have to work on a painting for months to get it right.'

Finally, Maisel received his degree from art school and set to work to become a professional photographer. At first he took evening jobs in factories—taking photographs during the day, working in the evenings, printing at night and sleeping hardly at all. Even so, six months of this showed him that photography was the way he wanted to earn his living.

He approached his father—not a wealthy man but, as Maisel says, 'always very generous in times of need.' As a result, Maisel's father gave him six clear months with a guaranteed income of $50 a week. He was on his way. Six months later he had established himself sufficiently to pay his father back.

In those early days at the end of 1950s he graduated fairly quickly from portraits of musicians, dancers and actors to assignments to cover the Newport Jazz festival, a series of advertisements for a pharmaceutical company and a range of album covers for Columbia. Like most photographers at that time, Maisel worked exclusively in black and white. It was only later in the early 1960s that he began to do the colour work that has now formed the basis of his considerable reputation. By this time Maisel was in his early 30s and had already been doing both editorial and advertising photography for some time.

As he says now, 'Colour was a natural evolution for me. Although I enjoy black and white photography, I like colour so much more. There's a sensuality about colour that I really like which isn't present in black and white. Often for me the interplay of colours is the content of a picture. Generally I would hope that a picture is more than just colour but I'm not embarrassed if an image stands purely on its value as an arrangement of colours and tones.'

Maisel traces the beginning of his great success as a colour photographer to a visit he made to Europe in 1963. During the time he spent there he shot 200 rolls of both colour and black and white, largely on commission for European clients—including an assignment for a major German advertising agency. But it was the colour that most interested him.

The early 60s were an exciting time for photographers. Illustrated magazines were still in their heyday and were beginning to publish colour more and more. Advertising was starting to create a great demand for photography. Major industrial conglomerates also began to pay large sums for high-quality colour photography for both their advertising campaigns and, increasingly, for prestigious annual reports.

Nowadays, Maisel's income still comes mostly from the commercial market, although he travels the United States and the world photographing everything from factories to landscapes for clients as diverse as the Texaco oil

Baja, California *The receding tyre tracks add a feeling of emptiness and space to this shot for a book about this desert landscape*

company, biscuit manufacturers and the *National Geographic* magazine.

Maisel has also bought himself a spectacular building in one of New York's most seedy areas, the Bowery. The building was a six-storey bank which Maisel bought in 1966 and converted. It now acts as a studio, picture library, home, office and photo gallery. Its conversion has been a consuming interest for Maisel that is rivalled only by photography itself. It provides him with a secure base from which he travels on the photographic assignments which sometimes take him away from home for over six months in a year.

With such a work load most photographers employ an agent to handle the business side of their work. But fairly early in his career, Maisel realized not only that he could make more money working on his own but that he actually enjoyed doing the deals. He has a reputation in the photographic world for achieving some of highest day rates around. His attitude is that if his clients want the best they have to pay for the best.

He believes it is important for young photographers to remember the business side of photography. 'I think everybody should get their commission in writing before they begin a job. Good contracts make good friends just as good fences make good neighbours.'

It is an attitude that also extends to the

Going on shift *A superbly composed shot of uranium miners taken for a Mountain Bell Telephones advertising campaign*

complex business of copyright. Invariably the deals he makes with advertising or industrial clients give him the right to keep any images that are not used and to retain the copyright on them. Some of these pictures then go to swell the vast files of transparencies that he keeps in his library.

Most of his transparencies are kept in the filing cabinets which line the walls of the office on the ground floor of his building—formerly the banking hall. This huge hall is big enough for a basketball court, and just to prove it, he has a basketball hoop mounted above the door. Whenever Maisel or his assistants tire of editing and refiling pictures at one end of the room, they can take time off to play basketball at the other end.

Besides this considerable library there is yet another picture store. This is housed in the basement. Here the bank's former vaults have been converted into a practically impregnable picture store which still retains the heavy iron doors that safeguarded its former contents. It is here that he keeps his favourite images and the rows of drawers containing his prints.

All his slides and prints are stored at a constant temperature to protect them against the colour shifts that invariably effect them in time. To achieve the maximum lifespan, all his prints are now made by the dye transfer process—an expensive method but one which has proved itself the most durable.

In spite of the vastness of his premises Maisel prefers the freedom of shooting on location and does not have the

patience for time-consuming studio set-ups. He may work in the studio if it is the only way to achieve a shot, but even then he will usually be trying to imitate a location.

However, he is now setting up a studio because he wants to work under controlled circumstances. 'I've bought an 8 × 10 Deardorff camera which I want to try out. I want to fool around with light using different subjects.'

To help him run his business, Maisel employs three full-time staff and one part-time assistant. 'The people I hire aren't usually people that want to be photographers. I try to avoid that as continuity is very important to me. Aspiring photographers are likely to move on after a while as assistants.'

Maisel takes an assistant with him on most of his commercial assignments. 'I feel I'm cheating a client if I go alone.' However when he is shooting for himself, he prefers not to have anyone else around. 'When I work for myself I would rather work alone. I get more depressed, lonely and introspective but the work comes out better.'

Although Maisel started his colour work using a Hasselblad as well as 35 mm—at that time only large format colour slides were acceptable—he now uses Nikon 35 mm cameras and Kodachrome film almost exclusively. He also prefers to use a hand-held meter rather than rely on the camera's TTL meter.

He brackets most shots and always uses a motor-drive. He thinks nothing of shooting a whole roll of film on one subject if he really likes it. He freely admits that he shoots a tremendous amount of material on assignment—partially to satisfy his desire for perfection and partially from a feeling of insecurity.

On a typical assignment, he shoots anything up to 30 rolls of film a day, but on major commercial assignments it may be even higher. This is often because he prefers to go on assignments where he has a very loose brief. So, in order to allow for a particular art director's tastes, he tackles the subject from a variety of angles.

One of his favourite assignments was a publicity brochure for Otis which was to illustrate the uses around the world for their products—escalators, elevators, inclinators and travelators. He travelled around the world on this assignment working a total of 40 days which he was free to schedule himself. It came closest to his idea of a perfect assignment.

Maisel does two or three such assignments every year—usually annual reports for major corporations. And he tries not to specialize. For him variety is an essential defence against boredom. He has to have the stimulation of different kinds of work. It is also one of the joys of photography.

'One of the great things about being a photographer is that you find out how ignorant you are with every new subject. You are always working with something new. And almost anything you do is grist

for your mill.'

But taking on assignments in a whole range of areas not only helps to stave off boredom. By refusing to be typecast Maisel has gained an enviable reputation as a photographer who can turn his hand to many different subjects and always produce striking results. And the more diverse subjects he covers, the more his reputation grows, so that he is now in the position where photographically the world is his oyster.

Maisel has little time nowadays for the constant arguments about whether photography should be regarded as an art rather than a craft—although at the beginning of his career, having just left his studies in fine art, he found the question a difficult one. 'At the time the general feeling was that being a photographer was something mechanical and commercial whereas painting had a much more elevated status. Today I'm much more interested in seeing how good the end product is. Only then can you judge whether that particular painting, craft or photograph is art.'

Until a few years ago only black and white photography was taken seriously so Maisel got together with two other renowned colour photographers—Ernst Haas and Pete Turner—to open a small gallery solely devoted to exhibiting colour photography. Now, with the greater respect for colour's artistic potential, Maisel has found that an increasing, although still small, proportion of his income comes from the sale of his prints.

Although Maisel makes no attempts to deny his highly commercial attitude to photography, it is obvious that his success stems from what can only be called his love-affair with photography. It is not just a means of earning a good living but a passionate relationship.

When people ask about his attitude to photography, he often shows them the view from his apartment window—an endless skyline of tenement buildings and apartment blocks. 'I only have to look out of this window at any time of the day to see ten or twenty pictures that I want to take. And every time I look they are different—the way the light falls on a building creating new shadows or different shades of colour, or the glimpse of a woman at a window, or an old man feeding pigeons on his roof.'

To Maisel they are all aspects of the rare beauty to be found in even the most apparently mundane scenes. And this is the key to his enthusiasm. As he describes it, 'I really enjoy seeing. I'm a little like the kids you see in the streets who walk around with radios glued to their ears. I do it with my eyes and a camera.'

In spite of this enthusiasm for

Rolling along the highway *The atmosphere created by late afternoon sunlight is one of Maisel's favourite subjects.*
The wink *A personal picture that Maisel took in a Sao Paulo market while he was travelling in Brazil on an assignment*
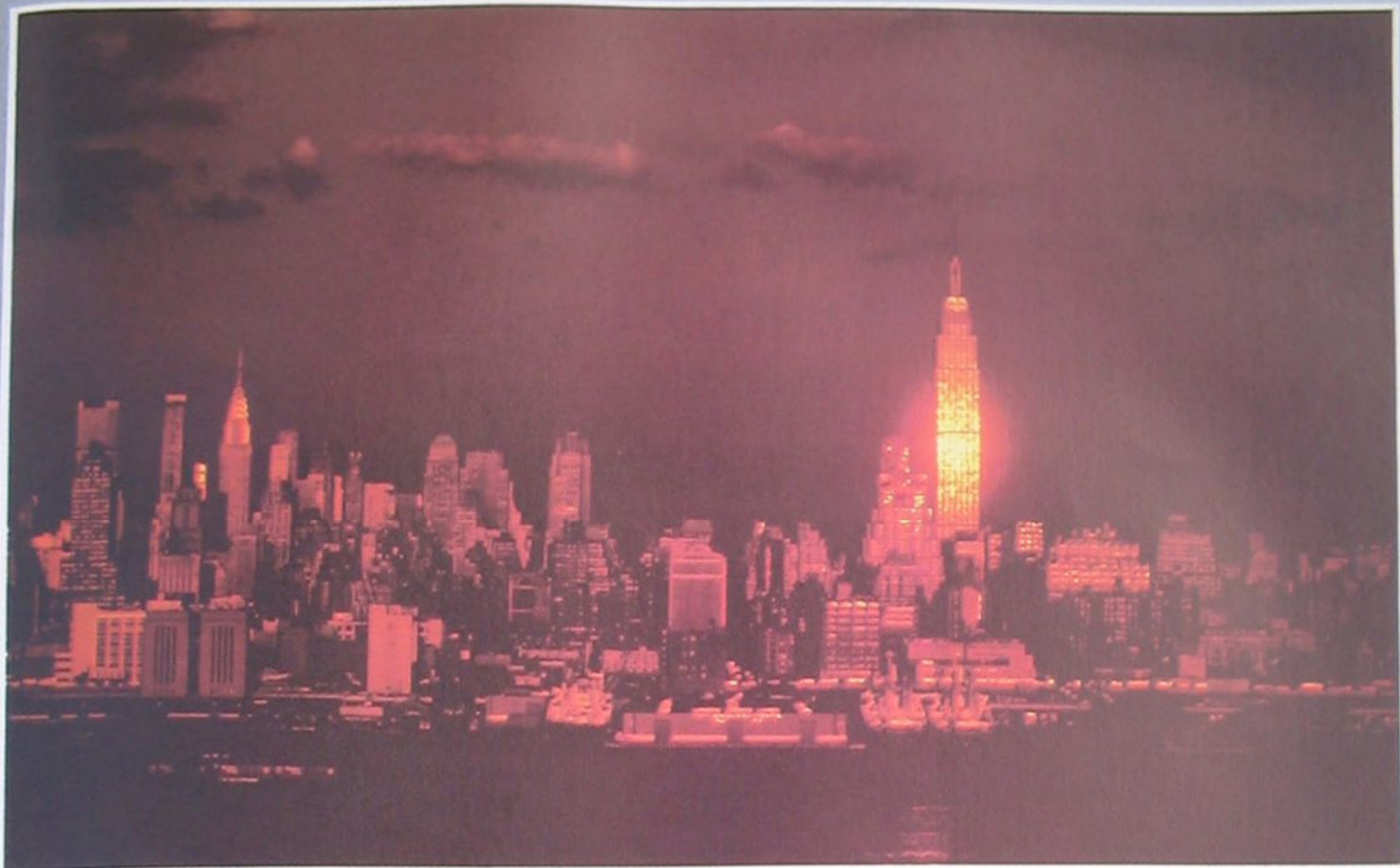
Jay Maisel

New York skyline *Sunlight glitters on the skyscrapers of Manhattan in this classic picture taken from across the Hudson river.*
Jet to the sun *By using a long telephoto (with a very fast exposure) at sunset, Maisel has enlarged and intensified the sun*

photography, even Maisel admits to occasional lapses of interest. But, as he says, 'Whenever I get tired of taking photographs I know I've done too much commercial work. Then I take a break and come back to it later. Everyone has fallow periods but they generally don't bother me too much as I like to potter around with other things.' But it does not usually take him too long to get back to photography, photographing his favourite subject—New York.

Maisel was born and brought up in Brooklyn and has rarely strayed too far from it. He is also a compulsive worker who is never happy unless he is doing something all the time. 'I love New York. There's a fantastically high energy level here. You have to work in New York because the people around you are a collection of compulsive ego-maniacs. It's a city where you have to work doubly hard just to keep your place. And besides that, which I thrive on, you can also have a very good time here. I think it's the most beautiful city in the world.

'I keep asking myself what I would do and where I would live if I didn't need money. And I keep coming back to the same answer. I'd do the work I'm doing now and I'd live right here—on the Bowery.'

Understanding...

Commercial processing

To handle the vast number of films sent in by the public, commercial processing labs have developed highly specialized automatic systems and many 'photofinishers' are beginning to exploit the power of computers


The vast majority of amateur photographers trust their films to commercial processing and printing laboratories. Few people have any knowledge of what goes on inside them, yet the work done by such a laboratory can affect the results you get much more than the quality of your camera, lenses and film. A modern laboratory—called a photofinisher or D & P (developing and printing) lab—is a mixture of advanced technology and old-fashioned hand work.

Getting your own back

It is important to make sure that each customer receives their own film and prints back, and even this apparently simple matter is now subject to electronic systems.

The simplest method, still widely used, is to make out a docket for each film and keep the cassettes in strict order. They are loaded in order on to a rack from which they can only be removed in the same order. Other systems involve numbering each film, and there are several ways of doing this. Paper labels will pass through the machines only if they are heat sealed on to the film—heat sealed tape is very strongly fastened. A machine automatically sticks one label on the end of the film and one, with the same number, on the customer's docket as it loads the film. Alternatively, a number is exposed on the spool end of the negative.

The most advanced system is found on Kodak's Disc film. Each disc has a number shown in bar code for an optical reader to interpret. It is also exposed on the disc and is even coded on a magnetic recording layer. This number stays with the disc for manufacture, and is therefore a very secure method of identifying it. In the most sophisticated version, the bar code is read using an optical wand by the
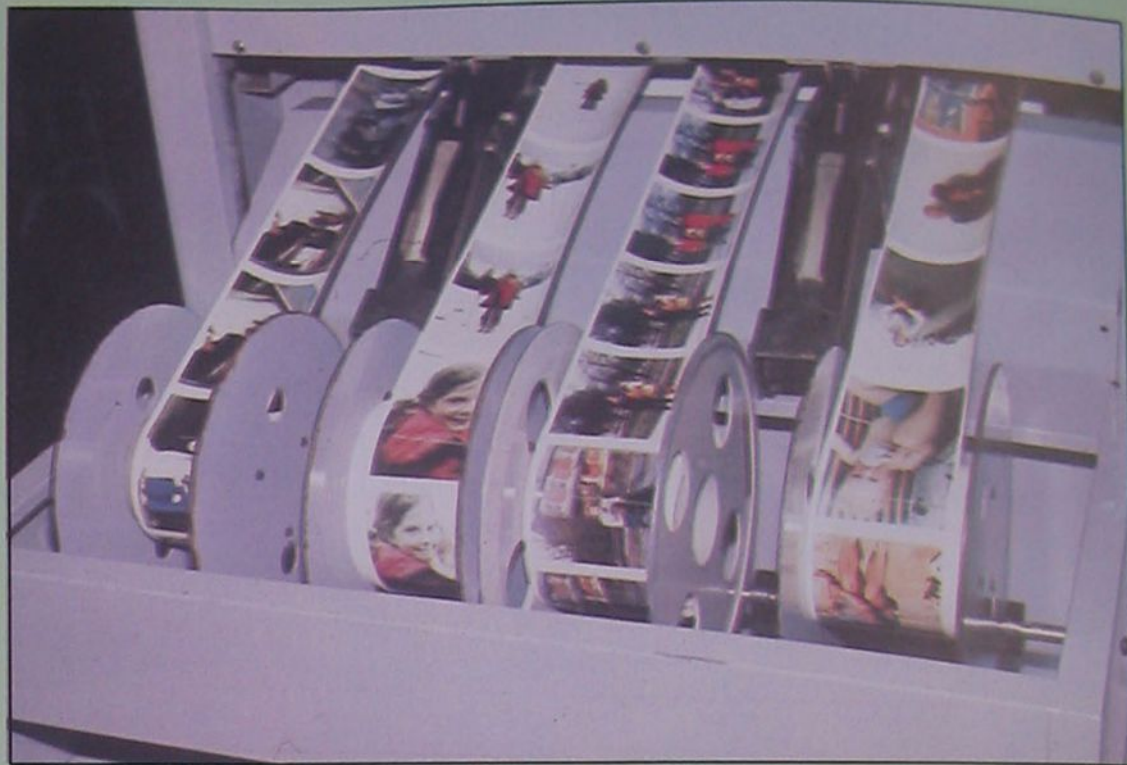
operator as the film is loaded in to the automatic machine.

After identification, films are spliced together and wound on a reel with blank leader and trailer on the ends. The reel is housed in a light tight magazine in which it can be taken to the processing machine.

Colour negatives

Virtually all makes of colour negative film are now processed by the Kodak C-41 process in Flexicolor chemicals. The solutions—colour developer, wash, bleach, fix, wash and stabilizer—are contained in deep tanks with rollers at the top and bottom. A drying compartment at the delivery end of the machine dries the negative with a current of warm air. When in use a continuous processing machine has to be kept threaded, so blank film base draws a batch of films through the machine and the processed negatives pull through further film base as they proceed through the solutions. A typical machine delivers dry negatives at the

rate of 20 m per minute which is equivalent to about 500 35 mm negatives a minute.

The temperatures of the various baths are controlled by thermostatically controlled heaters and the solutions are circulated by pumps and continuously replenished to restore the activity lost through use.

The reeled negatives are passed to the printing machine. Modern machines are fully automatic and are controlled by computer. Postcard-sized prints involve a fixed magnification of about 3½ times for 35 mm negatives but this can be changed to suit other negative sizes. The evaluation and exposing gates are interchangeable so that all the popular negative formats can be accommodated.

Fully automatic printing

The latest automatic printers do not need an operator constantly watching over them. Loaded with a reel of negatives and a roll of paper with the computer control set for the batch of paper and the make and type of negative

Auto prints are delivered in rolls after processing and then inspected by eye

film, the machine does the rest at the rate of perhaps 1200 prints an hour. Each negative is drawn into position over an evaluating aperture where its blue, green and red light transmissions are measured and the exposure sequence set. While this is taking place a previous negative is being printed.

A fast auto printer exposes by the subtractive method. At the start of the exposure, unfiltered light reaches the paper and when the paper layer requiring the least exposure has received enough light, a yellow, magenta or cyan filter is moved into the light beam by a solenoid to stop the light to which the fastest layer is sensitive. When the second fastest layer is exposed sufficiently a second filter moves into the light beam. The third filter moves into the beam to terminate the exposure, since three filters together stop any light

2380

reaching the film. The order in which the filters go into the beam depends on the characteristics of the negative and paper. At the fast rate of printing of more than 1000 prints an hour, the total exposure for each print is very brief—less than half a second.

Paper processing

Continuous processing machines for paper involve only two solutions—colour developer and bleach-fix. A final short wash is provided to remove all soluble compounds from the print emulsions. The prints are heat dried and delivered in a continuous roll.

The two solutions are continuously replenished and are maintained at the correct working temperature to within a small tolerance. The solutions are agitated by either circulating them with paddles or by bursts of nitrogen gas.

The finished prints are inspected and unacceptable ones that need to be reprinted are marked in black crayon. Despite automation, this task must still be done by a human operator. An automatic trimmer cuts up the prints and divides them into three lots: acceptable, those for reprinting and complete rejects. The current fashion for borderless prints reduces trimming to a single cut. The images on the roll of paper are separated by only a hairline of white and they go right to the edges of the paper.

Colour slides

Reversal processing of slide film may be done with a continuous processing machine similar to that used for negative films. Most reversal films are now processed by the Kodak E-6 chemicals and these involve nine steps calling for an elaborate machine. The alternative method is known colloquially as 'dip and dunk'. Films are hung in clips on frame with weighted clip on the lower ends. The frame is then lowered into deep tanks of solutions. Agitation can be by jets of gas or by simple raising and lowering of the films on their racks. Transfer from one solution to another can be manual or mechanized.

Black and white

Monochrome films are nearly always developed and fixed by a dip and dunk system, as a continuous processing machine is not appropriate for films that may call for different development times.

Automatic printers for monochrome negatives are similar to colour printers but are much simpler. The exposure given is an average for the whole negative area, which is not wholly reliable in the case of negatives with unduly large highlight or shadow areas. With some printers the operator is able to compensate manually for abnormal negatives.

As a *rollhead* printer can be loaded with only a single grade of paper, negatives of different contrasts have to be catered for either by *flashing* the paper for high contrast negatives or by using a type of paper whose contrast depends on the exposure it is given. If a paper of fairly high contrast is given a very brief exposure to light before it is exposed, its effective contrast is reduced. Printing machines often make provision for flashing.

Paper specially designed for photofinishing has characteristics such that a thin, flat negative can be made to yield a print of adequate contrast but negatives that are denser and of higher contrast give flatter results. This is not a wholly satisfactory answer to the problem of negatives of different contrast but it gives acceptable results in most cases.

Process monitoring

Colour processing demands careful monitoring if a high standard of quality is to be maintained. Exposed but unprocessed control strips on film and paper are available from material manufacturers and one of these strips is processed at regular and frequent intervals. Various key densities on the processed strip are measured and plotted on a process control chart. On this chart are indicated the limits outside which the selected densities should not go. Results outside the permitted tolerances indicate a fault such as incorrect replenishment or solution contamination. Adjustments can then be made.

Disc processing sequence

All stages in the Kodak disc film processing sequence can be fully automated: from magnetic identification (top) through processing and drying to printing (bottom)

OUTDOOR NUDES

Whether the location is a woodland glade or a desolate expanse of salt flats, photograping nudes outdoors frees you from the confines of a room or studio and allows you to combine the human form with the contours of the landscape

Nude photography is usually associated with studio work or at least some indoor setting where lighting and conditions can be carefully controlled. Yet once you start thinking about combining a nude with an outdoor location you will find that there is endless scope for creative photography.

However, choosing an outdoor location is not always easy. It is important to look for a place where there is some privacy so that there are no passers by to offend and so that the model can feel relaxed about the session—though professional photographers and models often ignore such niceties. In looking for a location, it is wise to aim for small secluded areas which offer scope for a variety of shots, rather than aiming for a wide, open vista. Look for small details— a patch of colour, rocks or trees with textures that can be effectively contrasted with the skin of the model, or perhaps a shapely rockface or a flat expanse.

A quiet stretch of beach may be an ideal location for your session. The water itself offers scope for shots of the model lying in the surf or splashing in the waves. The still, clear water of rock pools can be ideal for a set of abstracts— close-ups of sections of the model partially immersed in the water. Of course, the exotic feel of a beach location will only come across if you choose a clear sunny day for your session. A polarizing filter may be useful for strengthening the colours and for reducing the reflections on the water.

The grainy, high contrast black and white beach nudes made by Bill Brandt demonstrate some of the potential of such a location. His combination of selected parts of the nude form, and the curvature of the pebbles on the beach created superb abstract shapes that have become established as classics in photography.

A beachside location is by no means the only place suited to an outdoor nude session. A quiet stretch of woodland or a secluded field can offer equal scope. The shapes of trees and branches can be used to echo and complement the shape of the model, while ferns or tall grass can make a soft, atmospheric setting. If you can find a fast moving stream, try posing the model next to—or even in—the stream, asking him or her to hold still while you experiment with long exposures to render the water a delicate mist. Of course, you may also want to try using a fast shutter speed or flash to depict the model surrounded by drops of spray suspended in the air.

Pictures taken in such locations can

Male figure *An open stretch of salt flats in Utah and late afternoon light produced an atmospheric combination of human form and natural surroundings.* **Girl sitting** *A similar choice of locations, but here the early evening sky provides an ideal background.* **Breast and sky** *Close-ups offer the chance to experiment with an abstract approach*

Franco Fontana/The Image Bank

Michael Busselle

Red field *Outdoor nudes are good subjects for special effects—here infrared film and a sepia filter caused this unusual coloration.*
Rockface *Rather than simply setting the nude in the landscape, make the landscape and nude work together—here black and white film enhances the contrast in textures.*
Beach *Underexposure creates strong shadows in bright sunlight*

have a very natural look to them. In classical art, sylvan settings were very popular for nude studies since the figures became water or woodland creatures, rather than simply naked people. This approach is perhaps the least likely to offend people—the erotic or glamour overtones are easily played down, which is why it was much more acceptable to Victorian eyes.

There are occasions when a broader sweep of landscape can be included in an outdoor nude. For instance, in an area of gently rolling hills it is possible to combine a close-up shot of the undulating curves of the female form with the background clearly visible so that the similarities in shape are emphasized. The extreme depth of field of an ultrawide angle lens or a split field attachment on a standard lens could be useful for this. Alternatively, you can take two separate pictures and combine them later, by making a sandwich from two or more transparencies or by a combination printing technique.

Pastoral settings are usually the first
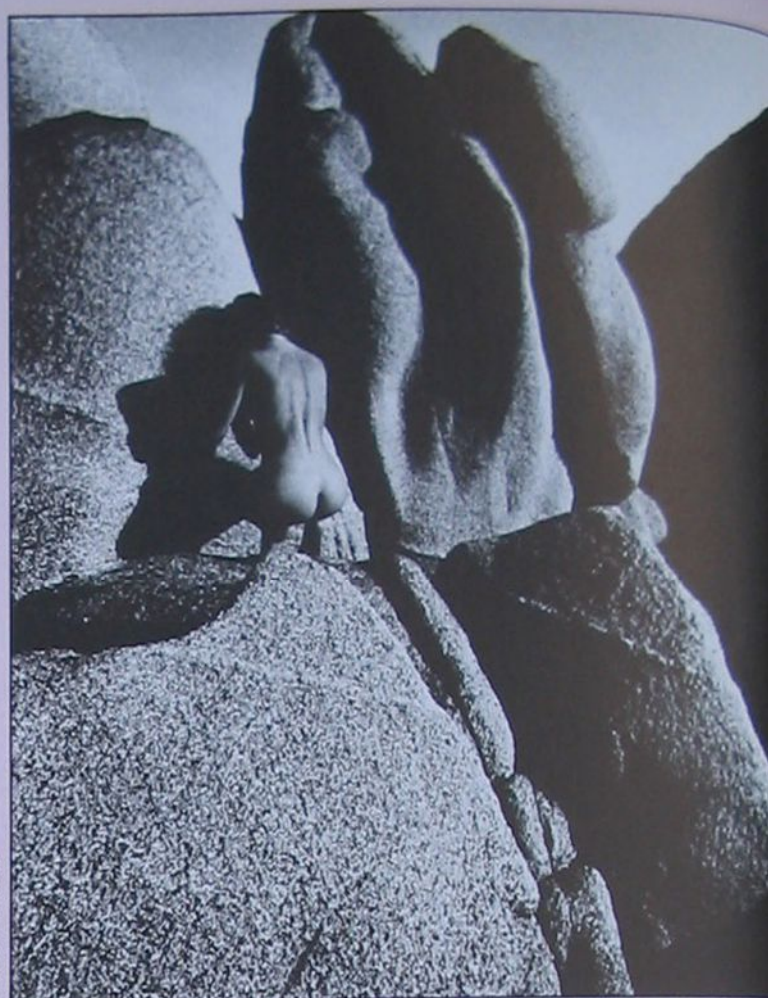
that spring to mind when planning an outdoor nude session but by exploiting the element of surprise it is possible to make use of far more unlikely locations. Great potential exists for the intrepid photographer and model who are prepared to venture out into urban locations—a well-known landmark or building, or perhaps a city park with a familiar skyline in the distance. Of course, authorities may frown on such

activities and it is likely to draw quite a large crowd—so the best plan is to shoot really early in the morning before everyone else awakes and work as quickly as possible! The effect of posing a nude model outside a famous government or regal building can often be very funny.

However, whether aiming for a comical juxtaposition or a subtle blend of human form in soft, natural surroundings,
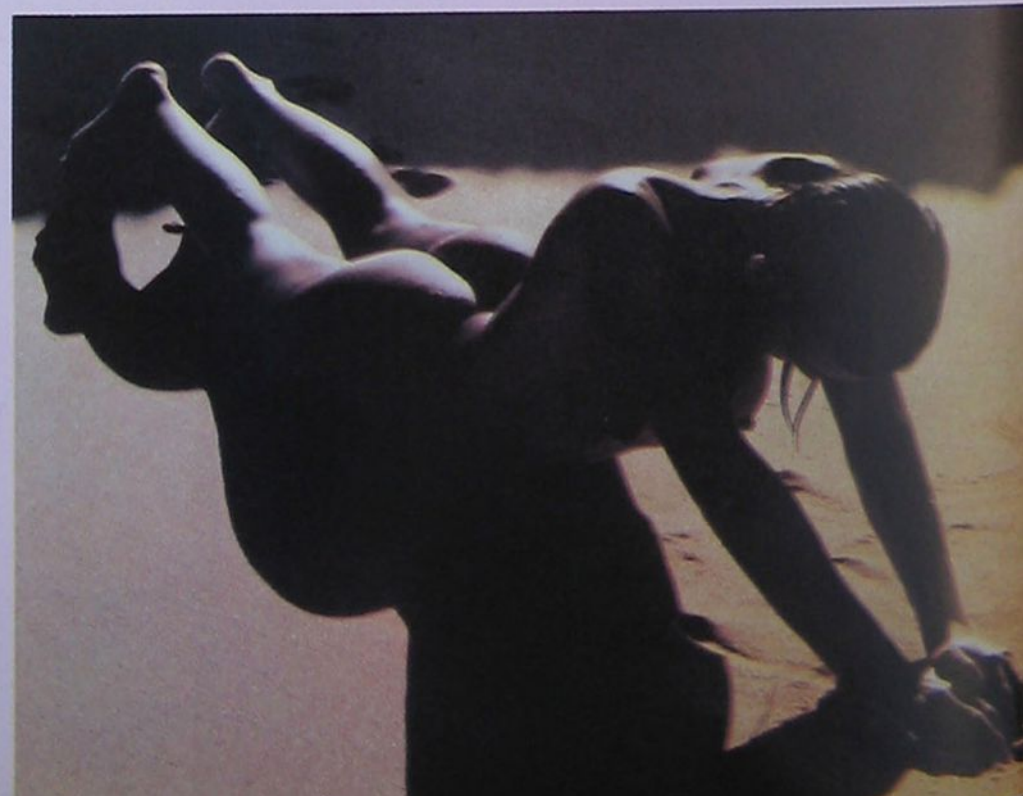
it is important to pay attention to the background.

The effect of the background is largely controlled by the choice of viewpoint. Shooting down on to the model posed on the beach from an outcrop of rocks is a simple way of achieving a plain, even-toned background. Conversely, by shooting from a low viewpoint—perhaps with the model standing on some rocks above you, the background can be the sky. Even the bluest skies can look washed out, so use a polarizing filter to deepen the colour.

Shooting outdoors allows you to use natural props to enhance your shots. Driftwood washed up on the beach, an old rusting plough, even a derelict car can all be just as effective as more conventional props like a piece of colourful fabric.

As in any picture, lighting is important, but it is particularly worth considering in relation to the background. Backlighting can be exploited to enhance the appearance of the model, particularly with hair light and skin texture. It can also play an important role in enhancing the background—whether this is sun playing on ocean waves or backlit flowers.

Special effects can be very useful in trying to create something more unusual with an outdoor nude. Infrared film, processing transparency film in colour

Swimming pool *Manmade features, such as this swimming pool, contrast well with the colour, texture and rounded form of the body*

negative chemicals, soft focus, warming or cooling filters can all be used to alter the actual appearance of the scene. Using flash in daylight can be particularly effective with this subject—try fitting a blue filter on the camera lens to colour the background and a warm correcting filter on the flash to render the model in a natural colour, under-exposing to create a day for night effect (see page 2241). High contrast black and white films are also well suited to this subject.

However, strong composition is far

Girl and rocks *Late afternoon light helps to give skin and setting, a warm tone which contrasts with the blue sky*

more important than special effects. Careful choice of location and sufficient attention to relating the model to the setting is likely to produce very satisfactory results. It allows you to spend more time attending to a satisfactory pose and to strong composition than in the studio where confined space can reduce the creative potential of your session.
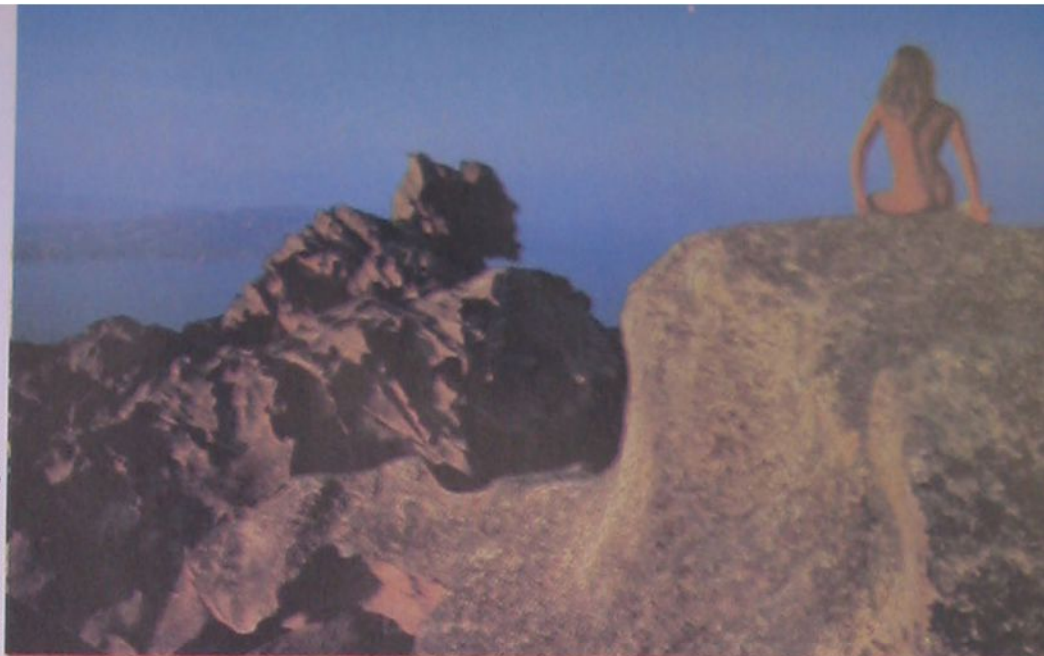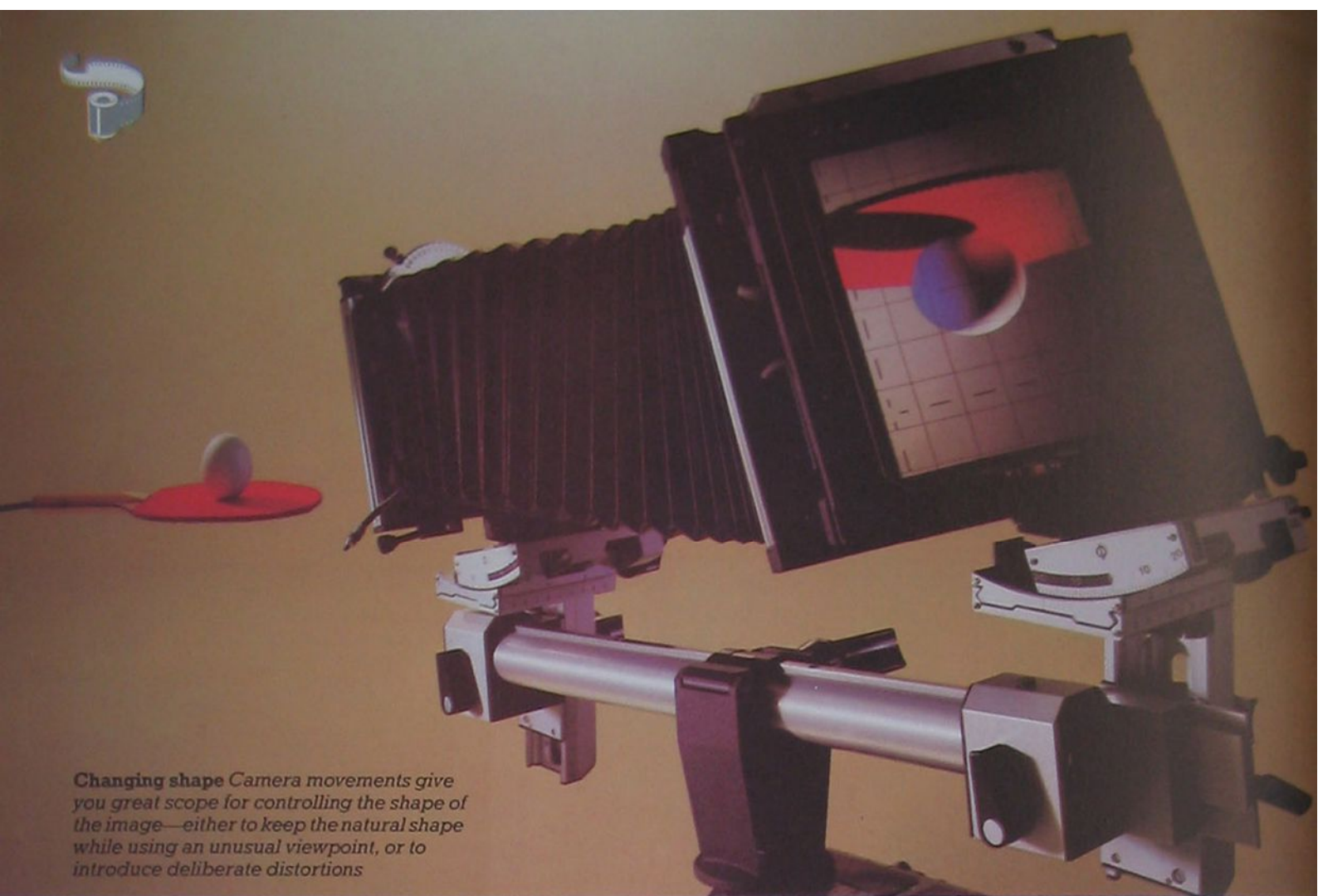
Changing shape *Camera movements give you great scope for controlling the shape of the image—either to keep the natural shape while using an unusual viewpoint, or to introduce deliberate distortions*

Improve your technique

Large format technique-2

Camera movements are an extremely useful feature of large format cameras. But you must use them carefully and methodically if you are not to end up with the wrong effect—or no effect at all

Many people think that a large format camera merely gives you a bigger picture. But these cameras have other advantages, the most important of which are the various movements that they allow. These camera movements give immense creative control. You can move the image on the film, alter the plane of focus, or even change the apparent shape or perspective of the subject.

But even though the effects of these movements are visible on the focusing screen of the camera, it is important to know what to expect before making a move so that you can work in a structured and logical way. If you work hapazardly you may eventually achieve the desired effect, but more often than not you will simply cancel out previous movements. For the sake of clarity, movements can be broken down into three main groups—shift, swing and tilt, and back movements.

Shift movements

The lens can be moved in four directions in a plane parallel to the film, and these movements are known as *shifts*. The vertical movement is known as a *rising front*. If the lens can be lowered as well, it is said to have a *drop front*. The horizontal movement is called *cross front*.

Rising front is the most common of all movements, and almost all large format cameras have this feature. A drop front is less common, but the effect of a drop front can be duplicated several ways.

At the simplest, you can just turn the camera upside down—some manufacturers supply a short outrigger for doing this with an ordinary tripod. Another approach can be used with technical cameras that have a *drop bed*. This is mainly used to swing the front of the baseboard down so that it does not appear in the picture when wide-angle

lenses are used, but with longer lenses the front panel—the *lens standard*—swings down with it. If the *tilting front* (see below) is used to bring the lens panel back to parallel with the back, you have an effective drop front. With a monorail, a similar procedure is possible. if the front and rear standards are both tilted so that they are parallel, the rail itself can be tilted until the standards are once more at right angles to the ground. This is known as *indirect displacement*.
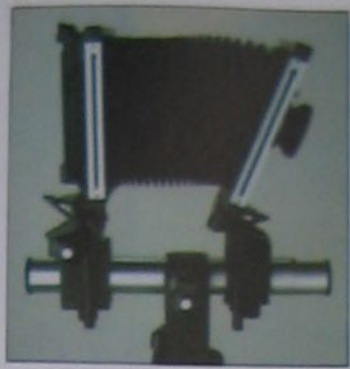
If cross front is not actually fitted, it can be obtained the same way. Just turn the camera on its side or (with a monorail) use the *swing* movements (see below) both back and front.

The effect of all the shift movements is to move the image on the ground glass or film. If the lens is moved upwards, the image moves upwards: if it is moved

Types of camera movement
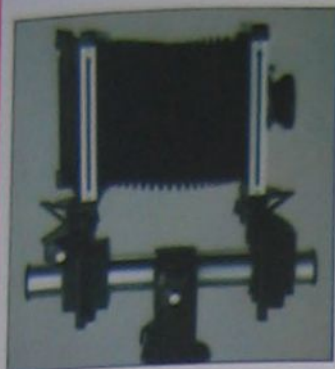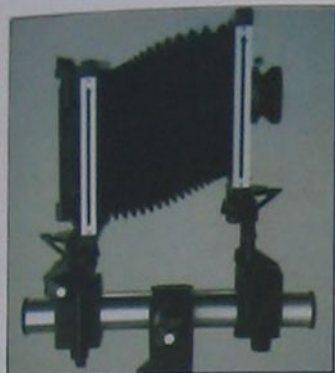

Normal position

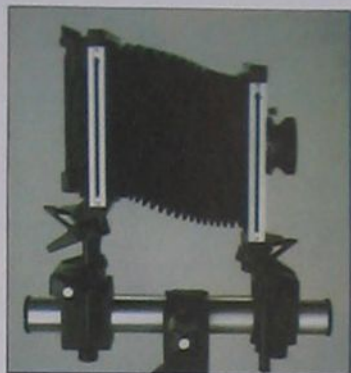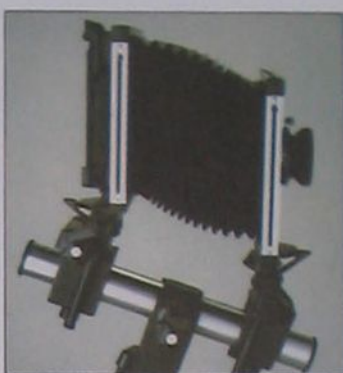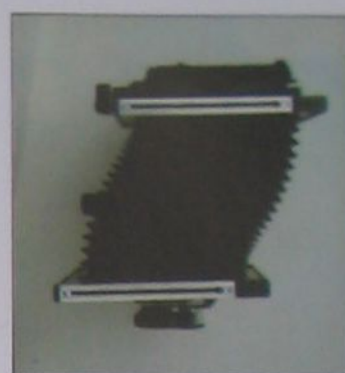Tilting front

Tilting back

Swing movement

Rising front

Drop front

Indirect displacement

Cross movement

sideways, the image moves in the same direction. There are many applications for this, but three are particularly useful. The first is in architectural photography. By using the rising front you can effectively cut out wasted foreground and show more of the top of the building, so removing the need to tilt the camera back and avoiding converging verticals.

Shift movements are also useful when you cannot place the camera where you would like to or when something obstructs your line of view. By using the shift movements you can place the camera to the left or right, higher or lower, and still get a picture which looks as if you had taken it square-on.

The third use of movement allows you to show 'impossible' perspectives, such as a head-on view which also shows one side. The results may look a little odd, but they have the advantage of retaining accurate proportions for the front while giving some idea of the depth.

There are two limitations on the use of shifts. The first is the mechanical construction of the camera—there has to be a limit to how far you can twist and stretch the bellows, though special 'bag bellows' help enormously with wide-angle lenses. With very long lenses, bellows units can be joined together to give extra length. The second limitation is the circle of definition of the lens—as you use more of the outer part of the image circle, resolution decreases and distortion and vignetting increase.

Different lenses have different characteristics, and on some the area of

Cross view *A straight-on viewpoint (left) gives little idea of the depth of the object. By using cross front the side of the object can be seen, though the front stays square to the frame (right). But using cross back as well introduces distortions (centre)*

Straight edge *Drop front has been used here to keep the edges of the door parallel while using a high viewpoint*

sharp definition within the general image circle is very much larger than on others. As a general guide, the slower the lens, the larger the sharp area.

In practice, there is rarely any need to have the latest and best lenses in large format work, because the degrees of enlargement are so small. With the very largest formats—10 × 8 and above—lenses dating from the early years of the 20th century are still in everyday use. Some of these lenses work best at very small apertures (f/45 to f/90) so a few photographers do not even use shutters —timing the exposure with a stopwatch and a lens cap is perfectly adequate for black and white work where reciprocity failure will not cause a colour shift. In bright sunlight, though, you may need to use a neutral density filter to make the exposures long enough to be controlled in this way.

Despite mechanical and optical limitations, the range of shift movements available on large format cameras vastly exceeds that available on any perspective control lens for smaller cameras, and it is available when using lenses of a wide range of focal lengths.

Swinging and tilting

Lens swings and tilts also involve moving the lens panel, but instead of being parallel to the film plane these movements are about the vertical (swing) and horizontal (tilt) axes respectively.

Their effect is quite different from shift movements, but they are similar to each other in that they have the same effect but in different planes. So it is possible, on cameras without swing, to get the effect of a swing movement simply by turning the camera on its side and using the tilt. Tilt is almost universal on large-format cameras, while swing is somewhat less common, being largely confined to monorails. So it is the use of tilt which is described here, though swing does the same thing on the vertical axis.

If a lens is tilted on its axis, the plane of focus tilts with it. This may seem at first to be nothing more than an optical curiosity, but in practice there is one major and one minor application.

The major application makes use of the Scheimpflug principle (see page 779). If imaginary lines drawn from the subject plane, the lens panel plane, and the image plane all coincide at the same point, then everything in the subject plane is in sharp focus. This may be a little hard to visualize, but an example makes it much clearer. Imagine that you

are trying to photograph a group of objects on a table. You want to show them in perspective, so the camera is conventionally placed on a tripod and tilted so that it is looking down on the table at an angle. You can only focus on one object on the table and may not be able to stop down far enough to get everything into focus. The minimum apertures of most large-format lenses are very small, but the focal lengths also tend to be rather large. Even at f/64 you may have trouble, especially with subjects which range from very near to quite far away—a few centimetres, perhaps, to a metre.

The film plane and the subject plane, if extended, coincide at a single point. By tilting the lens forwards so that the extension of the lens panel passes through the same point, you have all the apparent depth of field you want—even at large apertures—though it is not strictly depth of field in the usual sense, in that it only applies to a single plane.

The minor application of tilting occurs when you want to reduce the depth of field on a receding plane, so as to concentrate attention on a single subject. This happens much more rarely, but it is a useful trick to know.

This brings in the subject of *on-axis* and *off-axis* movements. These terms can apply to both swings and tilts, and refer to the optical axis of the lens, which is an imaginary line running straight through the middle at right angles to the lens elements.

Off-axis movements were the earlier type. They are cheaper and easier to design and manufacture, but they are more difficult to use. In a typical off-axis tilt, the lens standard (the posts carrying the board) is hinged at the base. When the standard is tilted, therefore, the whole lens moves either backwards or forwards, and the focusing must be adjusted accordingly.

With an on-axis tilt, the lens board tilts inside the standard, and the tilting axis intersects the optical axis. The result of this is that the on-axis image does not change focus—though, of course, the image above and below the axis does. This enables the effect of a tilt to be assessed immediately, without any need for refocusing, and so is quicker and easier to use. When you are more experienced, though, the off-axis tilt is not really all that much more difficult or time consuming.

Back movements

The backs of most large format cameras also feature some movements. Most have tilt, and possibly swing facility, while monorails also have shift movements.

Although at first sight back swings and tilts may seem to have the same effect as the corresponding front movements, this is only partially true. They may be used to duplicate the Scheimpflug effect, but because the image is thrown on to the screen at a more oblique angle, the image shape changes. It is, in fact, stretched out, and the perspective
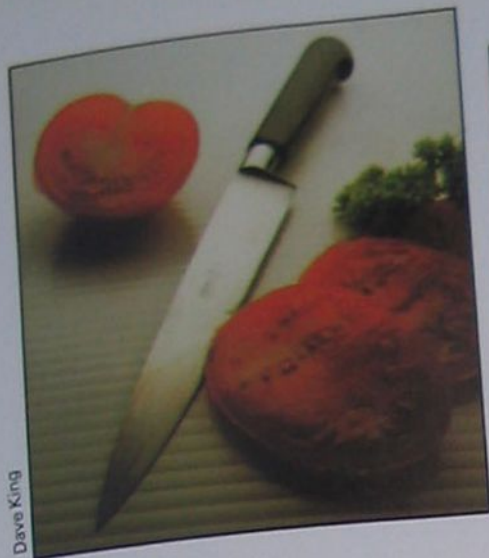
Dave King

Deep focus *Even at small apertures the depth of field with large format cameras tends to be too small (left). Using front tilt gives a plane of sharp focus which recedes from the camera, giving more depth (right), though excessive tilt causes cut-off (centre)*
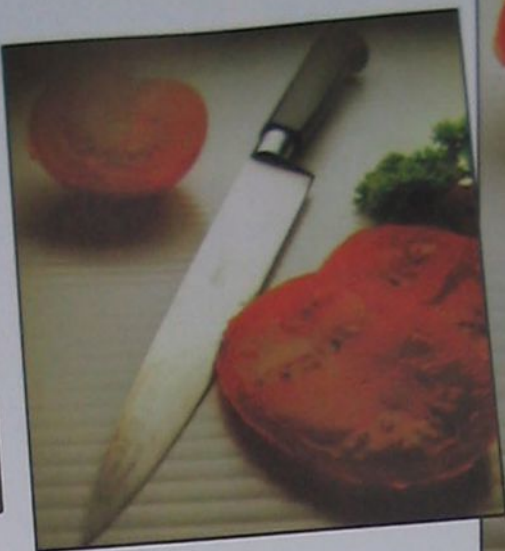
becomes steeper. So the real uses of the back movements are the alteration of image shape, and the alteration of apparent perspective.

By using the back movements, you can exaggerate or decrease existing perspective, or add a perspective effect to something which had in fact been photographed flat. Buildings are not the only possible subject—the same technique is used by advertising photographers to 'stretch' cars, or turn cereal packets into towering blocks.

Back movements are the only real way to 'control' perspective. As explained above front shifts merely move the image about on the film, so the only effect on perspective comes from not having to tilt the whole camera. The effect is easily seen by analogy with a projected slide. If you move the projector up and down, the image moves with it, but if you tilt the screen at an angle then the image is distorted.

Tilting the back of the camera has exactly the same effect. That part of the image which is furthest from the lens is bigger than that part which is nearest. It is also probably out of focus. Swinging the lens to try to increase apparent depth of field simply results in making the two standards parallel again (in the case of a flat non-receding subject) so the only new effect is a shift. Consequently, focus is controlled by conventional focusing plus plenty of stopping down.

If the back is swung or tilted and then the whole camera is moved so that the back occupies the same position in space as it did before it was swung, the net result is a front swing or tilt. This demonstrates that there is more than one way to achieve a given effect. It also shows how essential it is to work in an orderly fashion, so that use of one movement does not cancel out another.

General procedure

When you use camera movements, the first essential is a really substantial and rigid tripod which can be locked solidly wherever it is set. Even if the camera is reasonably balanced to start with, it is very easy while setting the movements to make it unstable without really noticing.

In addition, careful levelling of the camera and 'zeroing' of all movements before use is very important, otherwise it is all too easy to set up one of the movements only to find that your efforts are worthless because another movement was not at zero.

As with the basic manipulation of the large format camera, the most important thing is to work in a disciplined 'checklist' manner. The first thing to do is to consider the effect you want, and the second is to work out how to get it. This may sound obvious, but almost all newcomers to camera movements fail to do it and waste time fiddling aimlessly with

Swing depth *The swing movement is similar to tilt (see above) but in a different plane. In this shot, the arm of the lamp goes out of focus (left). Using swing makes the plane of focus parallel with the arm so that it is sharp throughout (right)*

the movements.

Although there may be occasions when it is appropriate to work in a different sequence, the easiest thing to do is to run through each of the options in turn. First, ask yourself if you need front shifts. If so, can you get them simply by using the camera's shift movement, or will you need to resort to the kind of tricks described earlier? Secondly, ask the same questions about front swings and tilts—and remember that if necessary you can augment them by using the back movements and then moving the whole camera. Finally, repeat the process for the back swings and tilts. Once you are used to this approach, you will find that each time you use the camera it becomes easier. Although the procedure seems tedious and complex at first, it soon becomes a natural part of taking photographs.

Dave King

2389

COUNTRY GARDEN

George Wright shows how, with patience and imagination, beautiful photos can be taken in the quietest country garden

There are few prettier sights than an English country garden in full bloom but they can be notoriously difficult to photograph well. So when George went along to photograph his neighbour's garden, he was up with the lark to make the most of the soft early morning light.

The day began bright and sunny, but soon became overcast. However, this suited George perfectly as he explained: 'For an overall view like the opening shot of the couple and their garden, the scene is brought to life by open sunlight, but for detailed shots of plants the diffused light of an overcast day is much better—there is no problem with shadows and contrast.'

George's choice of subject matter illustrates how much more effective it is to move in close, rather than trying to shoot overall views which often turn out as monotonous expanses of green where no individual plant can be singled out

Proud owners *This was one of the few times when George was glad to have bright sunlight to liven up the scene. 28 mm lens, 81A and polarizer. Kodachrome 64*
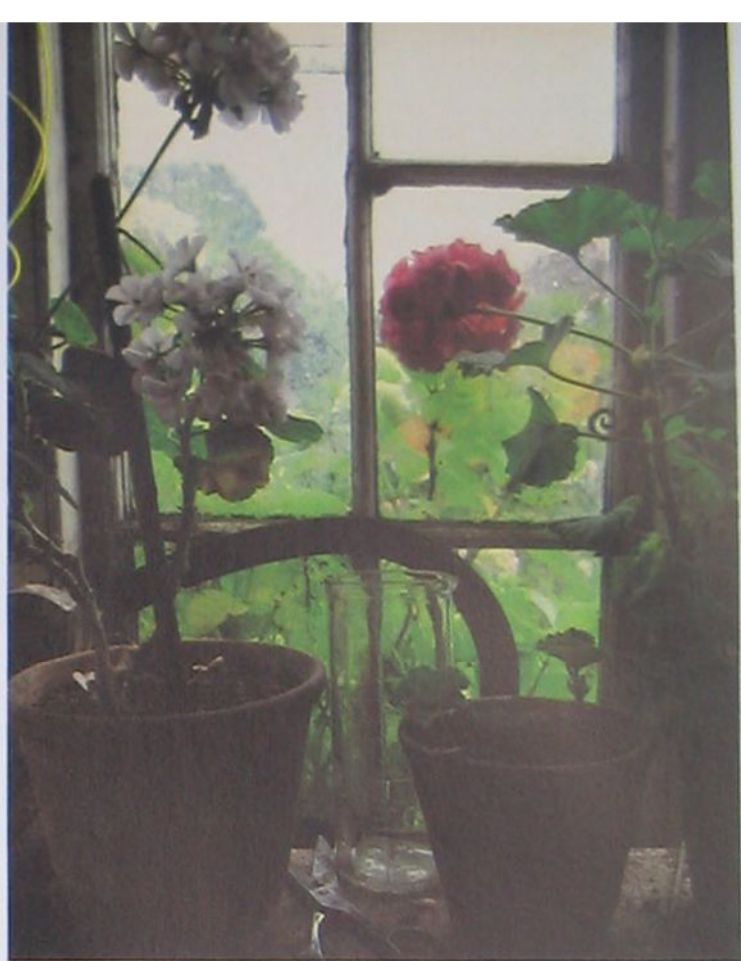
Old shoes *For maximum sharpness George used Kodachrome 25 and a 55 mm macro lens. 4 seconds at f/32.* **Gnome** *The ladybird and gnome made an unusual subject. 55 macro, 1/125 second at f/16.* **Snail** *Slight underexposure added drama. 105 mm lens with PK-11 and PK-12 tubes, ½ second at f/11 with 'a little burst of flash'.* **Lily** *For this close-up, George used his 105 mm lens with a PK-11 extension tube*

George Wright

Red bush *For extra interest, this shot was framed to include the church. 28 mm lens, 81A and polarizer.* **Potting shed** *To reduce the green cast from reflected light, a 10M filter was fitted to the 28 mm lens.* **Wheelbarrow** *George arranged for a fire to be lit for this 200 mm shot.* **Peas** *Window light was used after spraying the peas with water. 105 mm lens and two extension tubes*
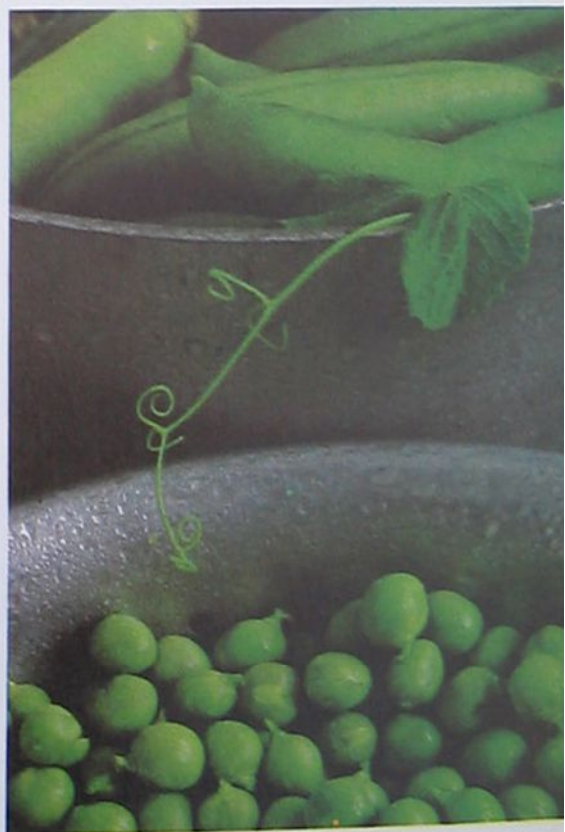
Assignment

from the others. The pictures here also show that in a garden there is far more to photograph than just plants—a wheelbarrow, a pair of old gardening shoes or a group of tools can all make good subjects which build up a more interesting and varied view of a garden.

Photographing a garden is not without technical difficulties. One of the main problems is what George calls the 'wobble factor'—the movement of plants caused by even the slightest breath of wind. This causes a blurred image with

Shooting a water lily
For this shot, the Nikon F3 was mounted on the inverted tripod column for the low viewpoint. A reflector added light needed while an 82A (pale blue) filter made the colour cooler. A polarizer reduced reflections
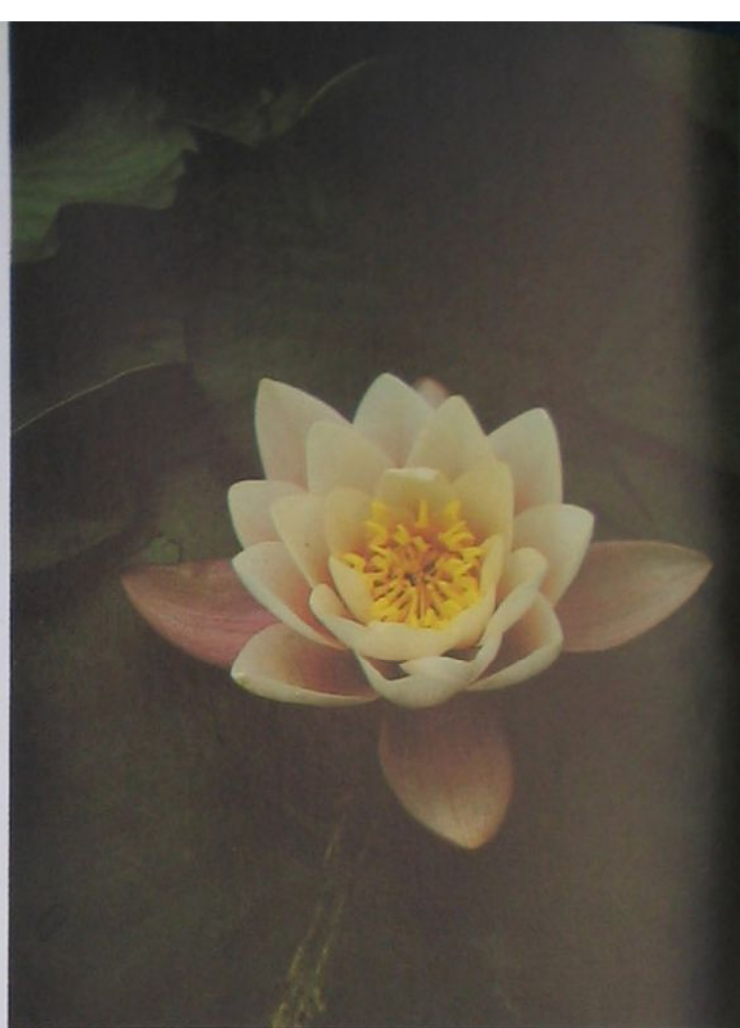
Pea pod *To provide diffused back-lighting and an uncluttered background, George suspended a sheet of tracing paper behind the subject and used a reflector to bounce light back on to the front of the subject. For this set-up a 300 mm lens was used together with three extension tubes, 81A and polarizing filters*

shutter speeds of less than about 1/30 second and is particularly annoying because close-up work invariably demands very small apertures. There is no satisfactory solution to this—George just had to wait until the wind dropped.

Allied to this problem is the difficulty of focusing on close-ups with an ordinary split image focusing screen. For this assignment George preferred to fit a type 'E' screen to his Nikon F3. Not only did the fine-ground matte focusing spot allow easy focusing, but the etched grid also allowed careful composition and enabled him to see whether a stem is moving by comparing it to one of the upright lines marked on the screen.

George Wright

What went wrong?
Silhouettes

The silhouette is a useful device in photographs, since it can create strong graphic effects. Colin Molyneux gives his opinions on four attractive shots

This photograph looks like everybody's dream location—palm trees, sunset and sea—difficult to see how anyone could go wrong. But there is one very obvious fault with this picture—the bottoms of the tree trunks are far too close to the edge of the frame. They need a little more space under them to prevent the subject seeming to fall out of the bottom of the picture. A slight change of camera angle downwards would have corrected this fault, or if the photographer wanted to include the small cloud at the top of the picture, then a few steps backwards would have had the same effect. On reflection, I would have shot with a telephoto lens from further back to keep the relationship of the headland and trees the same but to make the palms fill the frame more. This would also have put more emphasis on the sky and the clouds on the horizon

This scene cries out for a vertical format. The fantastic sky which is the most interesting element in the picture should have been the dominant feature. As it is, the horizontal shape chosen by the photographer has not made the most of the sky or the silhouette of the chimney. In a scene like this where the background is the important feature the foreground should be kept as simple and as graphic as possible, to complement and not distract from the main subject. I would have framed this shot as an upright and cropped so that the chimney occupied the bottom third or so of the frame with just a fraction of sky showing on either side of it. This would have produced a strong vertical feeling to the picture and put much more emphasis on the sky where it belongs. It would also have removed the unsightly TV aerials from the lower left of the frame


Everything in this picture is just too far away, with too large an area of little interest. Much more impact could have been achieved if the photographer had been more selective over the viewpoint, moving in much closer so that the man and his rod were the dominant features in the frame. An angle that positioned the fisherman so that an area of sunlit water was directly behind him would have been ideal, and if the photographer would have included part of the sunlit path as a diagonal from bottom left to top right so much the better. Many photographers make the mistake of standing too far from the subject and leaving uninteresting, unimportant and often distracting detail in the frame. For impact get in close—or if you want a wide shot then make sure there is something in the foreground to give the picture depth

Without being able to see what lies off to the left of this picture it is a little difficult to criticize it constructively, but bearing this in mind I think the composition could have been improved in two ways. First, I would have chosen a higher viewpoint and at the same time dropped the right hand side of the foreground so that it started in the right lower corner of the frame thus making the line of reeds a more definite diagonal. Second, positioning the building on the right side of the picture, combined with the more pronounced diagonal, would have resulted in a more balanced composition. These changes would have made more of a feature of the water and the building's reflection, and would also have prevented the tips of the reeds on the left from merging into the building, placing them against a lighter background for better separation
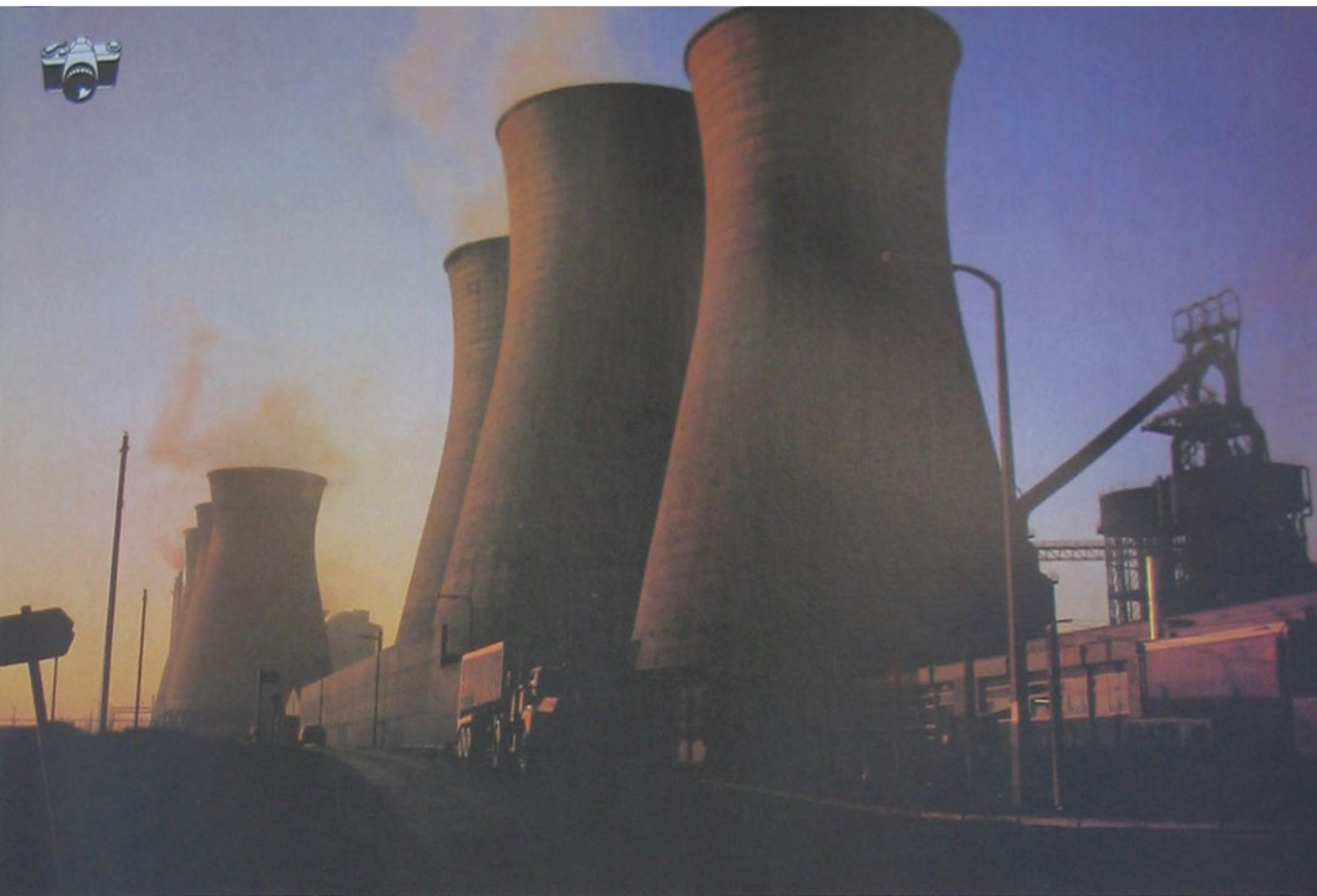
Creative approach

The INDUSTRIAL SCENE

For many people, industry is ugly and unphotogenic, but, for the creative photographer, the motley colours, textures and shapes of the industrial scene—and the activity—can provide subjects far more fascinating than any rural vista

So many people now live in urban settings that the industrial skyline has become their everyday landscape. The power stations, warehouses, refineries and factories are more common sights than rolling hills, mountains or forests. But this is not to say that as photographic subjects industrial areas have less potential than farmland, picturesque villages or the coast. There is, in fact, almost unlimited creative potential in the wide range of features that make up the industrial scene.

With a subject so vast and widespread, a lot of thought has to be given to deciding what particular areas to concentrate upon and how to treat them creatively. For most people who photograph the areas where products are mined, manufactured or processed, shots have to be taken from a relatively distant point of view. Only if you are a professional industrial photographer or you actually work in industry are you

Cooling towers *The mood of an industrial scene is mainly determined by the light— early morning or late afternoon is particularly effective*

likely to be able to get an inside view of what goes on and how people go about their daily work. However, much of the creative potential of the industrial landscape can be exploited without actually having to get behind the scenes.

Choosing either a theme or a specific location is the most likely way of producing strong pictures. One of the most frequent industrial themes in photography is the way that the means of production dominates the environment and the people living in it. Approaching the subject from this point of view entails relating the industrial buildings and processes to the surroundings. But it is important to distinguish between placing a scene in its social or environmental context and producing a cluttered shot in

which the surroundings distract the viewer's attention.

Telephoto lenses are useful for juxtaposing a selected part of a scene with a particular background. A photograph of a power station with its enormous cooling towers could be taken from a distance across a stretch of rooftops to relate the towers to the consumers. The telephoto effect would draw everything close together in the frame emphasizing the proximity of industrial complexes to the residential areas. In an area surrounded by unspoilt countryside, a river or patches of green fields could be placed in the foreground with an industrial monolith rising up in the background. This kind of shot can often highlight very effectively the way modern man's mark has been imposed upon the landscape.

This relationship. between industry and the surroundings is an important concept to bear in mind and there are

numerous ways of pursuing it photographically. The pit-head winding gear of a coalmine could be photographed so that it looms over and dominates the miners' houses. Alternatively, you may be able to find a viewpoint which allows a comparisons of the petrochemical plants outside cities like Venice or New York with the familiar urban skyline visible in the background.

These long range telephoto shots do not always have to be contrived so that two contrasting areas are included. Photographing an industrial town or city from a high viewpoint can allow you to produce striking overall pictures of the place with row after row of terraced houses interrupted only by huge factories or smoking chimneys and with the oppressive polluted air hanging heavily above. Shots like this rely upon light as much as composition to make them successful. The low angle of the sun at early morning or late afternoon will greatly improve such shots. One effective way of making attractive pictures out of industrial settings is to shoot at sunset—either using the dramatic colours of the sky as a background or shooting with a long telephoto so that the sun itself is included in the shot—a large orange orb with industrial buildings or machinery silhouetted in the foreground. So rather than the clutter and grime of the typical industrial landscape, you simply see the black skyline which, quite often, is full of fascinating shapes. A few plumes of smoke might complete the composition.

Alternatively you could wait until after the sun has sunk and photograph an industrial plant with its artificial lights adding to the afterglow in the sky.

Grey, flat roofs and streets appear far more photogenic after a fall of rain, particularly if the sun breaks through the clouds. The light striking the wet slates and pavements will give contrast to a scene which would otherwise look very flat. The bright highlights can make it difficult to establish the correct exposure—so look for a surface with a neutral grey tone and take a reading from that before composing your shot. Under such weather conditions you may also find that the sky above is dark and forbidding while rays of sunlight are still playing on the buildings and roads or white smoke rising in to the sky. These are almost ideal conditions for photographing the industrial scene and are more likely to produce atmospheric pictures than a blue sky and bright sunshine.

Even without special permission, there are many ways of getting more detailed photographs of industry. The social aspects are relatively accessible —people on their way to work, lines of unemployed workers queuing for jobs, children playing in grimy narrow streets or even photographs of a housing estate built to accommodate the work force. However, it is also possible to get close enough to some industrial sites to be able to use a short telephoto lens to close
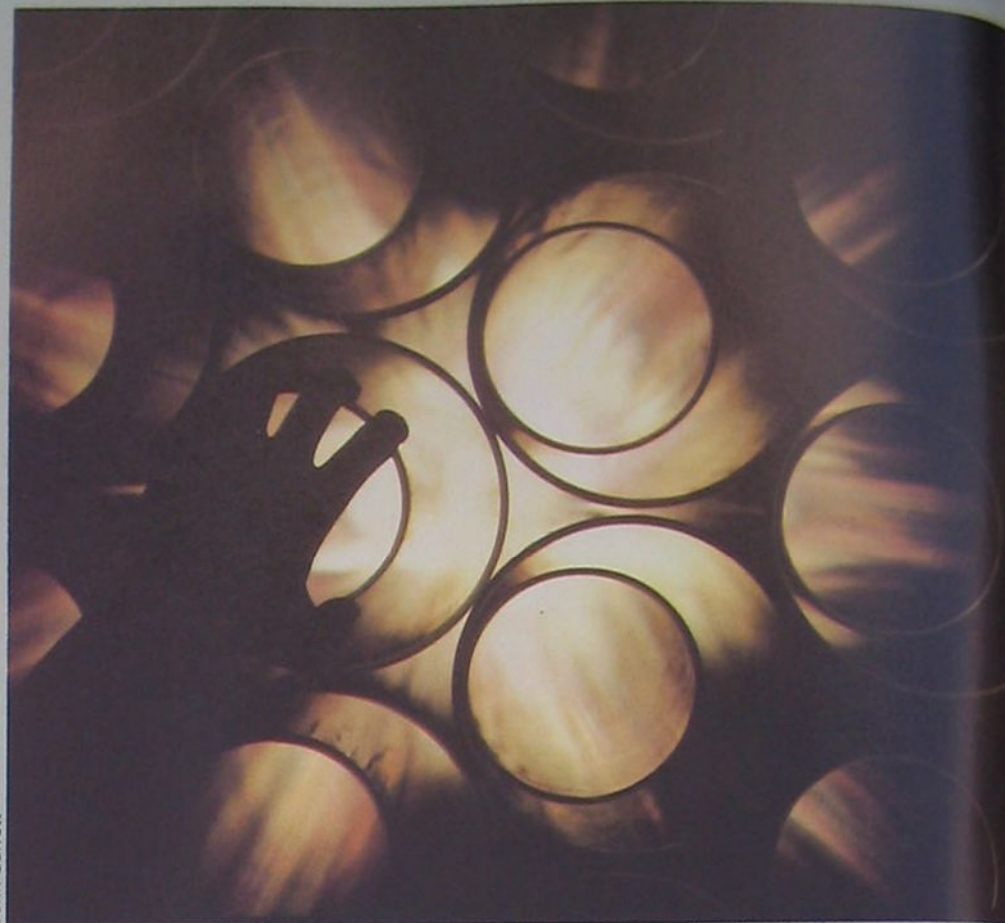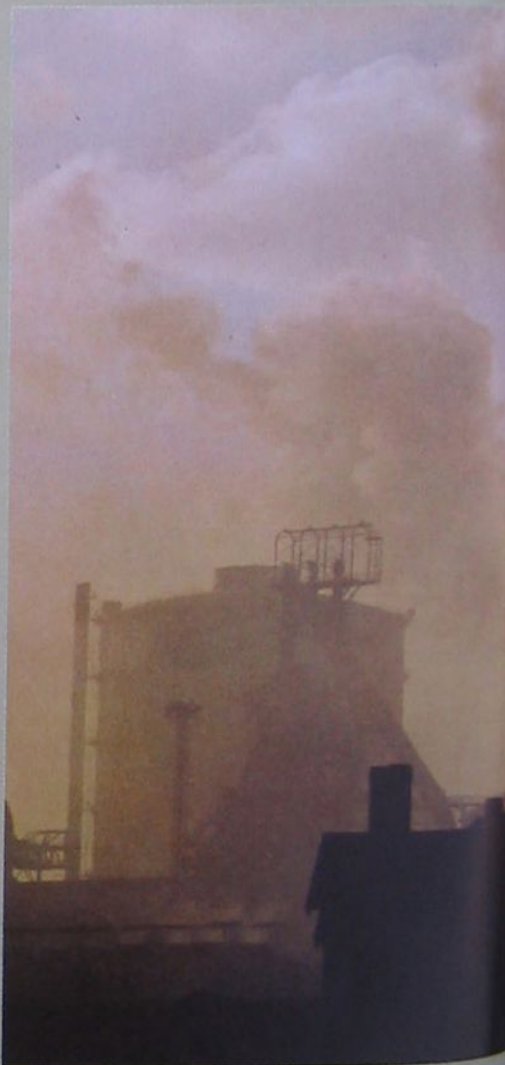

John Garrett

Hands at work *If you have the opportunity to photograph people at work, do not forget to look for close-up shots.*
Refinery at night *An early evening sky can make a colourful background for industrial scenes—especially if there is also artificial lighting to provide colour contrast and to illuminate the foreground.* **Polluted skyline** *The smoggy clouds that often hang above industrial complexes make very dramatic photographs and highlight the less pleasant aspect of industry.* **Woman at work** *Black and white film is well suited to photographs of people at work and creates a timeless quality—subjects like this can provide a whole series of shots*

in on details of refinery pipes, stockpiles of materials or finished goods. With shots like this it is less easy to relate the subject to its surroundings so it is often more effective to concentrate on isolating patterns or interesting details. Whether the subject you choose is the pipework of a petrochemical plant, all compressed together with a telephoto, or chimney stacks or lines of finished motorcars, the best policy is to keep your compositions simple and to concentrate upon the shapes you see in the viewfinder, paying special attention to the background and the surroundings to avoid distractions. Industrial sites, particularly the old and well established ones such as steel works and coal mines, tend to be a jumble of stockyards and a variety of buildings, which make these locations particularly confusing to deal with at closer range.
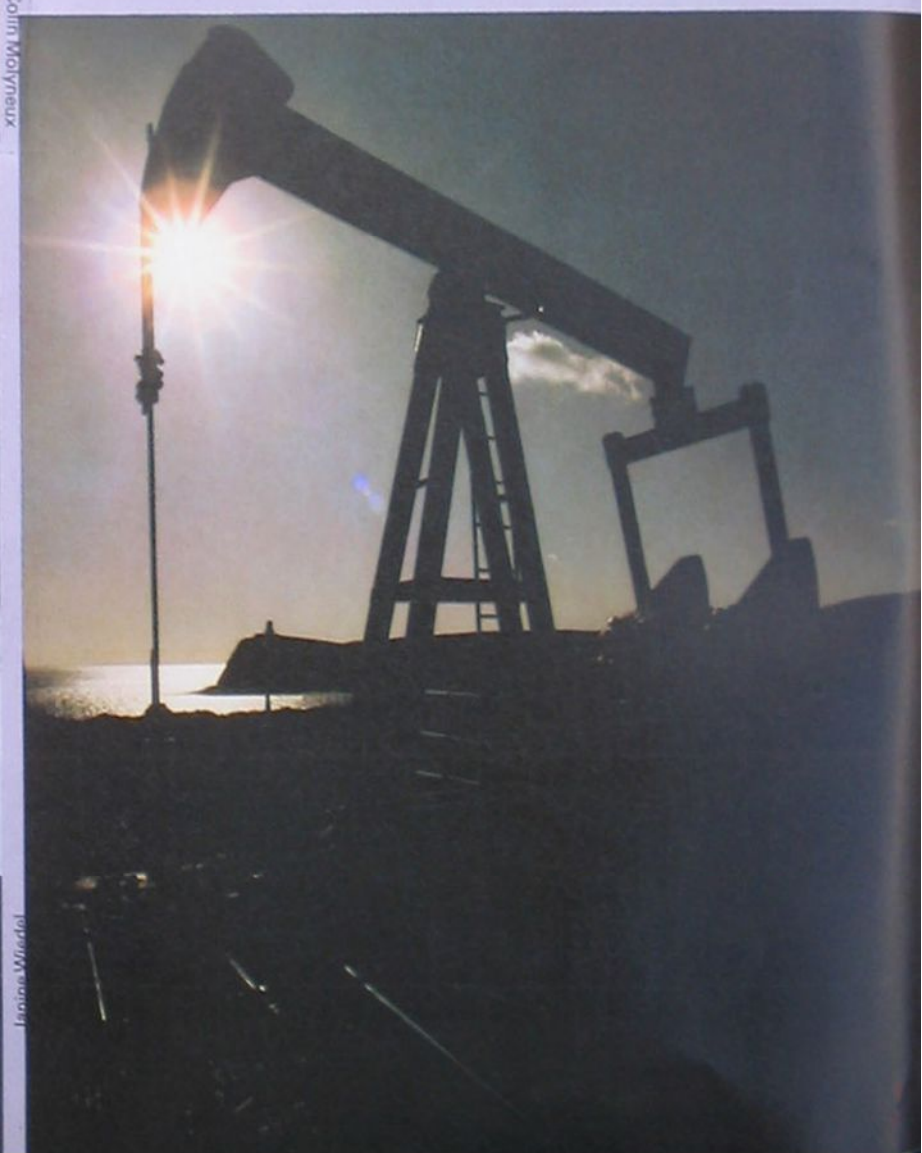
A problem with more detailed shots is

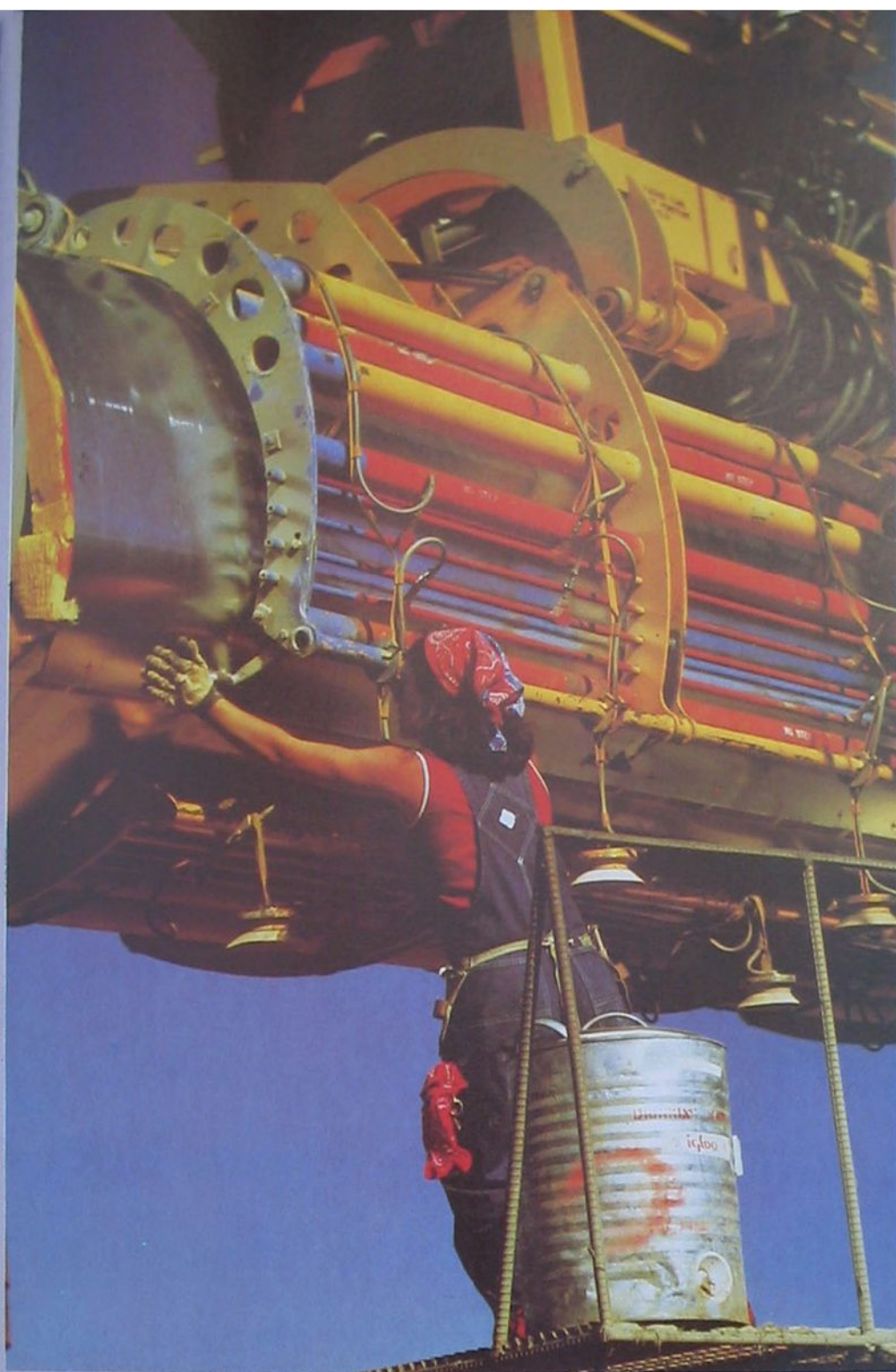Pat Wood/Tony Stone Photo Library

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Janine Wiedel

Colin Molyneux

create some spectacular compositions. Forget about always keeping these lenses straight and level to avoid converging verticals. By using extreme angles of view on modern buildings you can create striking graphic images while also including foreground detail for added interest. Wide angle lenses used close range can also be used to create impact and to bring dynamic qualities to a subject. Earthmoving equipment or heavy trucks appear even more powerful when photographed with a wide angle lens from a low viewpoint and the results create a stronger sense of involvement on the part of the viewer.

Any opportunity to photograph the interiors of large industrial complexes should be exploited as much as possible since it offers a rare glimpse usually only seen by professionals. Certain industrial work is particularly photogenic—for instance, a welder at work with sparks flying around and his visor, lit up only by the heat of the metal he is joining. Take care to avoid looking directly at the bright light created by welding and try and take a reading before the work is started, closing down about one stop to avoid overexposure—this also applies when shooting such subjects as molten steel or red hot iron bars.

With all interior shots, try to get the colour balance right to suit the film you are using. Since wide depth of field is often called for, you will probably have to resort to fast film. While details of machinery, raw materials or finished goods can look interesting, generally the best pictures show people doing something—preferably actually working at their jobs. A technician in a newspaper print room checking a newspaper surrounded by a massive printing press, or a paint sprayer spraying a brand new car are the sort of activities that are particularly worth looking out for.

Another, far less attractive, aspect of industrialism which should be of interest to the photographer concerns pollution and the damage which is often evident around highly industrial areas. This may manifest itself in the form of unsightly smoggy clouds hanging in the air—a form of pollution that in the right light or at sunset, can produce dramatic colours in the sky.

However, other forms of pollution—debris floating in a river, oil washed up on the beach or withered trees, can be ideal subject matter for a set of pictures or even a photo essay. Once you start to look for evidence of pollution it is possible to find a wide range of subjects that relate to this basic theme—crumbling masonry in historic buildings, streets full of litter or abandoned cars marring the countryside.

Clearly there is so much scope for creative photography in the industrial scene that it should be regarded as one of the prime locations for taking pictures. With imagination and by taking care over choice of viewpoint, industry can be photographed vividly without even having to get close to the main subject.

Vautier/de Nanxe

Cityscape *Tightly packed roof tops often provide good subject matter, especially when picked out by a telephoto lens. Try shooting after a fall of rain when the shining rooftops give a scene more contrast.* **Shafts of light** *A workshop floor looks particularly atmospheric when there is daylight falling through the windows—the more common overhead light sources tends to make an interior look too flat.* **Nodding donkey** *The distinct shapes of oil pumping aparatus respond well to backlighting so that they are reduced to simple silhouettes.* **Alaska pipeline** *A polarizer enriched the colours and made this outdoor work look more attractive. Underexposure by about a stop—occasionally two—can often help to saturate colours even further*

finding an image that is strong enough to stand up on its own. It is easier to find interesting shapes on a large scale industrial site such as an oil refinery where exposed pipes and framework can create attractive shapes. Often machinery construction seems to mimic shapes found in nature, such as dust extractors which branch off into smaller sections, or the intricate organization of railway sidings—all of which resemble the shapes of a tree and its branches. Bearing in mind ideas and comparisons like this can prompt a series of pictures all on a basic theme.

If you do have the opportunity to get in really close to your subject, then wide angle lenses—the wider the better—can

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Improve your technique
LOCATION STUDIO

Being on location does not mean that your shots have to be of lower quality.
With the right equipment and a little extra care over backgrounds and lighting
you can get results indistinguishable from those taken in a studio

Roger Hicks

There is usually a distinct difference between a photograph taken in a studio and one taken on location. Both amateurs and professionals regard studio quality as the utmost of which their equipment is capable, but often expect quality to suffer once they are in unfamiliar territory. Yet there are ways of creating studio conditions in even the least promising surroundings.

You might, for example, wish to photograph some interesting object which you discover while on holiday, far from home—a fossil embedded in rocks,

Intense shots *These shots were taken on location in Tibet using tent lighting. The Guru (left) was lit with available window light plus reflectors. The skull bowl (above) suffers from lack of depth of field as small flashguns were used*

a work of art or even an example of local craftsmanship, perhaps. You may be interested in taking photographs of particular objects as part of your hobby, from car badges to antiquities. In each case, the simple snapshot probably will not be adequate, and you will wish that you had better facilities at your disposal.

But if you are prepared to take care over your photography when you are away from home, there is a great deal you can do to improve matters, and even to produce results of studio quality. The main restriction is that you simply cannot carry all the lights and backgrounds that you normally associate with studio work. Even so you can get by with surprisingly little additional load.

The camera and accessories

Although most amateurs automatically expect to use their regular camera, it is worth considering how a professional would approach the problem of taking studio quality pictures on location, maybe in a remote part of the world where service facilities and even simple items are hard or impossible to obtain. The ideal would be a roll film camera with a wide range of facilities, such as camera movements and interchangeable lenses. Some cameras, such as the Linhof Technica 70, offer this. Alternatively, a reliable roll film camera with more restricted facilities, such as a Hasselblad, could be used. If both these were out of the question, a professional might use a top quality 35 mm camera with a range of lenses, including shift and macro lenses.

But whatever the camera, it is important that the shutter should be completely mechanical, using no batteries, or offer manual speeds if the batteries fail. Though batteries are widely available, and you can take spares, they can sometimes let you down at the worst possible moment, and your spares may also turn out to be faulty. Few professionals would feel happy at relying solely on an electronically controlled shutter when at a remote location. Other essentials would be a light meter—again, one using no batteries such as the Weston Master, a

full set of filters (see page 1806) and perhaps a colour temperature meter.

A tripod and cable release are essential. The tripod should be as sturdy as you can bear to carry—a flimsy one is worse than useless.

It is always worth using a viewfinder magnifier when working with 35 mm. This makes focusing much more precise, which is important if you want high quality results.

Backgrounds and lighting

While the equipment you carry must largely depend on what you regularly use and have available, the main problems with attempting studio work on location involve the backgrounds and the lighting.

Large quantities of background paper are obviously not practical, and even small quantities will soon become creased, dirty and useless. Whenever possible, you should use 'natural' backgrounds, and improvise where necessary. This applies particularly to portraits, where it is thoroughly impractical to carry a sufficient area of paper to make any difference. There are, however, two other possibilities.

The first is black velvet. A piece a metre or a metre and a half square will fold down to a very compact bundle, and may be shaken out adequately flat to be used as a backdrop to any local artefacts—pots, knives, small statues, works of art and so on. Because it is such an efficient absorber of light, black velvet simply will not show up in a colour transparency where the subject is correctly exposed. This makes the subject appear to float in space, which can be very effective. The only drawback is that it can become monotonous.

The second possibility is locally obtained fabrics. This is especially true in India, where light cottons in a wide variety of colours are obtainable very cheaply. 'Double width' (two metre) fabric can be used either reasonably smooth, or gathered to give the effect of drapes. Heavier fabrics can be used in the same way as the black velvet to give a little variety.

Unless the background is important, or
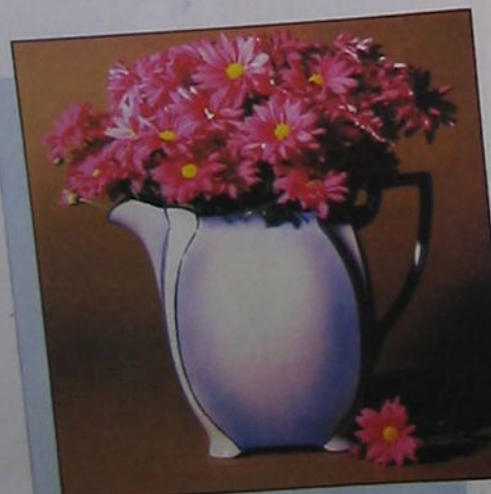
Softer light *Quartz lighting is useful but can give hard shadows (left). Putting a diffuser in front of the lamp (below) gives softer lighting (right)*

unless the subject is actually resting on it, the best approach is often to use a wide aperture and selective focus so that it is not very clear. Provided there are no violently contrasting patches of colour or brightness, this should not be obvious.

Lighting is even more of a problem. Ideally, you should work with available light whenever possible. This makes no demands on erratic power supplies or heavy, expensive and irreplaceable batteries, but it is also unpredictable in colour, quantity, and harshness.

Each of these variables is, however, controllable. The first, colour, is only important if you are using transparency film, and can usually be corrected with filtration: this is where the colour temperature meter comes in. It cannot easily be corrected, however, if it is changing quickly (for example, at sunset) or if it derives from fluorescent tubes, as in a museum or other building. Evening light can add character to a shot as it becomes redder, but fluorescent lighting (or worse still mixed lighting) is disastrous: a CC20M filter, an FL-D or FL-W (see page 260) may improve fluorescent lighting, but the results will still be unpredictable and possibly unusable. The only real possibilities are moving the subject, turning off the fluorescents and working by daylight, or adding artificial light, such as flash.

Indoors, it may be possible to increase the amount of light simply by opening curtains and doors. You may increase the lighting by several stops in this way. It may also be possible to shoot at another time, when the sun is shining from a different direction. But if the light is simply coming from the wrong direction then reflectors are needed.

Reflectors can be as simple as a sheet of newspaper or a piece of white cloth—even a T-shirt will often make a significant difference—or they may be purpose-made. Three of the most useful possibilities for studio photography on location are: aluminium foil, crumpled and then smoothed out before being stuck on a piece of cardboard or packing case (the crumbling helps prevent 'hot spots' in the reflected light); white fabric stretched over light wooden frameworks (use bought laths or bamboos, or even wood cut from trees); and purpose-made reflectors, such as the Lastolite.

Plain white or textured silver reflectors do not alter the colour of the light—the main difference is that textured silver reflectors are more efficient. Some people use gold coloured reflectors for flattering skin tones.

The plain white reflectors can also be used as diffusers to modify harsh, directional light: a typical diffuser might reflect 50 per cent of the light falling on it and diffuse the other 50 per cent through it. Once again alternatives include large pieces of white cloth. These can be pinned in a window, like curtains. There is also the possibility of using a black Lastolite, or something similar, to shade the subject or to prevent reflections from
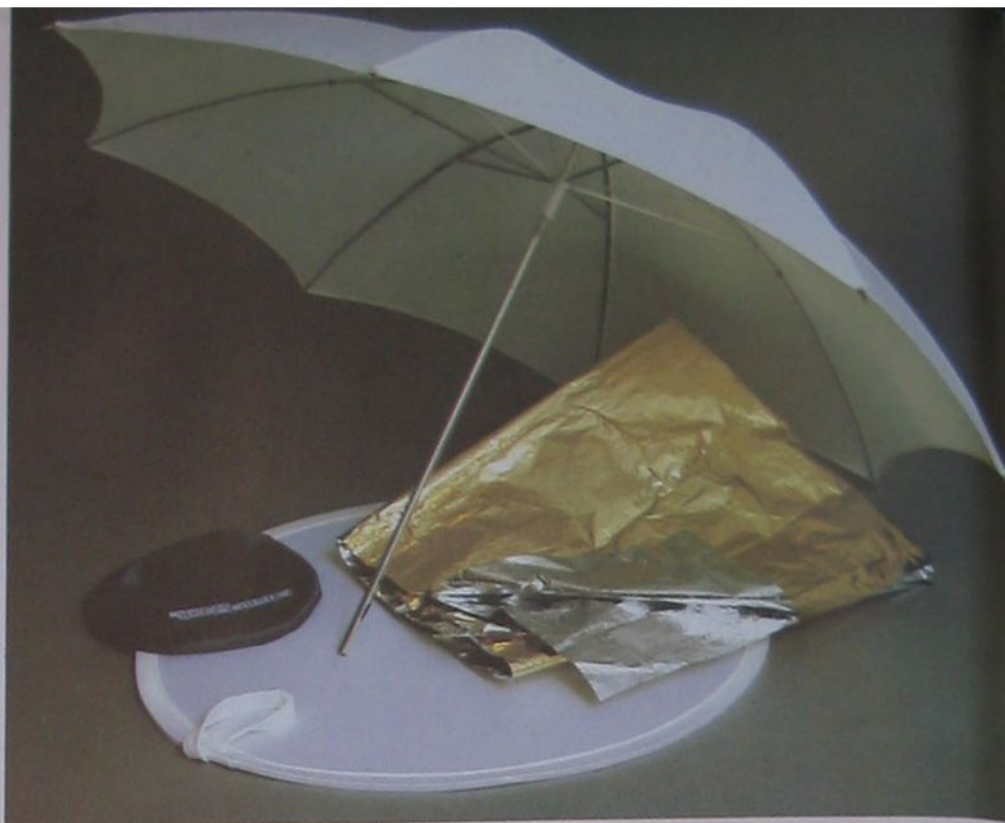
Useful accessories *Above are the best types of reflector—foil, umbrella and Lastolite (which folds to the size of the small blue bag). The bracket (right) allows you to fit a flashgun to a tripod, for easier and more versatile lighting*

nearby surfaces.

There comes a point, however, where there is simply not enough light, and reflectors and diffusers are of no use. Very long exposure times should be avoided because of *reciprocity failure* (see page 466). At this juncture, you are forced back on additional lighting. Simple on-camera flash is extremely unlikely to be able to deliver the effects you want, so multiple flash will be needed. An alternative, if the power is reliable and if you can totally exclude other light, is tungsten lighting—preferably tungsten halogen—with plenty of spare bulbs. But this involves carrying a considerable extra load.

The best form of additional lighting is therefore flash. A good set-up will include a large powerful gun, preferably with switchable power, and anything up to half a dozen small guns with slave units. These can be quite inexpensive, costing less than a couple of rolls of transparency film each. With just one extension lead for the big gun, you have a main light source with plenty of fill-in; you can also group the small guns together for greater intensity.

You should make sure if possible that all the guns run on the same size of batteries—the AA pencil-cell size is fairly universal and is easy to carry. An excellent idea is to carry rechargeable (NiCd) batteries, if there is any chance of being able to recharge them. A well-planned expedition will use AA batteries for everything.

To hold small flashguns in place, use

tape or putty-type adhesive. Lightweight tripods can also come in handy, offering you good control over positioning. If you use a tripod, buy the adapters sold for attaching flashguns to lighting stands, which have a tripod screw fitting insert.

A flash meter is also essential, though it is a bad idea to rely on it totally, particularly because you will need a battery to run it. In practice, a Polaroid test is almost the only way to be sure of high quality results (see page 614), but this means you must use a roll film camera with a Polaroid back.

A Polaroid test allows you to check both the effect of the flashguns and the exposure, which you scale up or down according to the speed of the film you are using. It is also true that errors, things left in shot and so on, show up more clearly in a Polaroid than in real life. Even with a Polaroid test, bracketing of exposures is advisable; without a Polaroid, it is essential.

Unduly harsh flash lighting can be softened with reflectors and diffusers, as already described, but for shadowless lighting of small objects (up to, say, 60 cm high), a *tent* is useful. This is no more than a lightweight framework covered in thin white cloth, inside which the subject is placed. Black velvet provides a background, while the top, sides, and front (with a hole cut for the camera lens) diffuse and reflect the light. If you are staying in one place for some time, you can have one made up by the local carpenter, or you can lash one together yourself from sticks and gaffer tape. Some people even take collapsible frames of aluminium. The easiest shape to make, and to work with, is a cube—but if you have two, or better still, three light tripods you can make an excellent tent with these.

The easiest approach is to set up one tripod with a transverse pole which holds the velvet as a backdrop. The second tripod forms an 'A' at the other end, with its third leg extended and gaffer-taped to the tip of the first. With white cloth draped over the whole assembly, and held in place with clips or clamps, the result is a very useful tent.

The result is ideal for photographing small objects under diffuse lighting—you can either use daylight or flash. Even if you shine the flash from one side only the effect of the tent will be to make it quite non-directional. If you are photographing a shiny object it might be neccessary to make sure that the inner framework is completely covered by the white cloth.

Even white cloth can have a slight coloration, so if you are using transparency film you should do a trial run if possible. You may find that an 82 series blue filter will be needed to correct for a yellowish cast, though the bluish colour of flash or even a cloudy day might overcome the colour of the cloth.

But the most important factor in this kind of work is meticulous attention to detail—and for this you need patience.

Setting up a tent
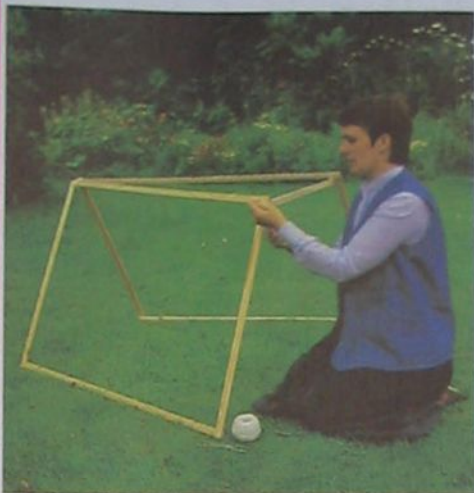
The best material for the frame is thin wood or bamboo which can be either taped or nailed together

Place the object you want to photograph on a suitable background, and then cover the frame with white cloth
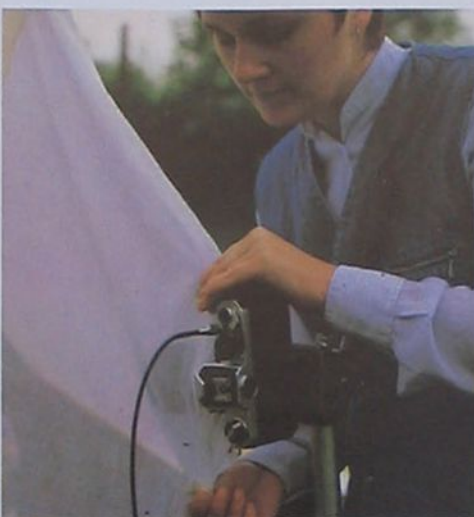
After setting up the camera, preferably on a tripod, cover the front of the tent with cloth, making a hole for the lens

Use a hand-held meter, rather than the camera's built-in one. The best way of metering is the incident light method

With some types of cloth, especially if it is fairly thick, you will find that the shot has a slight yellow cast

If the light in the tent is too yellow, use an 82 filter to correct. If in doubt, shoot pictures with and without the filter

Mike Newton

Optical calculations-1

Optical calculations look very complex, but with a pocket calculator you can fairly easily work out the coverage, magnifications and lens extensions essential for close-up work

Object and image distance

subject (object)

film plane (image)

u = subject to lens distance (object distance)

v = lens to film distance (image distance)

In all optical calculations these two distances, u from the subject to the lens and v from the lens to the focused image, are crucial

Object at infinity

object at infinity

$u = \infty$

$v = 50$ mm

When the object is at infinity, the image is focused close to the lens and the value of v is the focal length of the lens

Object close-up

close-up object

extension = 12.5 mm

$u = 250$ mm

$v = 62.5$ mm

When the object is close-up, the lens must be moved further from the film to keep the image focused and so v is extended
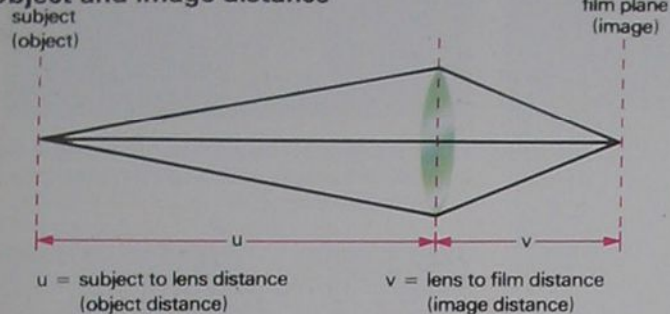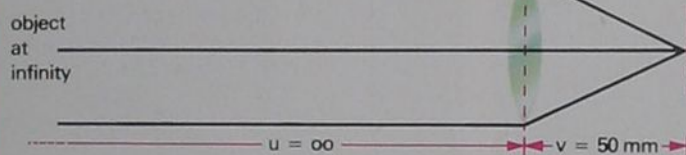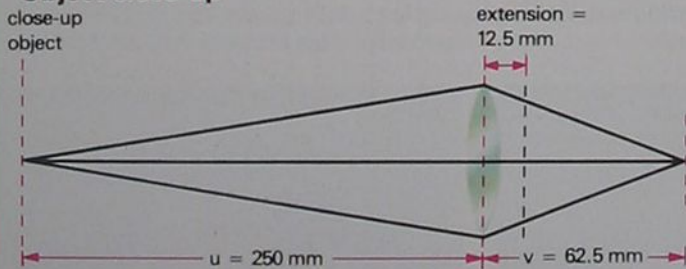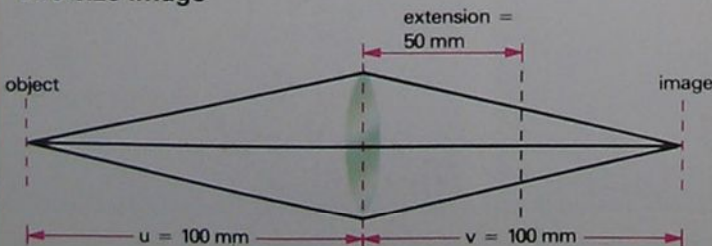
Life-size image

object

image

extension = 50 mm

$u = 100$ mm

$v = 100$ mm

For a life-size image, the lens must be moved forward so that both u and v are equal and twice the focal length of the lens: $m = v \div u$

Many people these days have a pocket calculator, whether of the simple four-function type, which simply allows you to add, subtract, multiply and divide; or the scientific type, with *trigonometric* functions such as *tan* and *sine*, as well as time-saving keys such as *squares* (a number multipled by itself) and *reciprocals* (one divided by the number).

There are a number of formulae in photography which from time to time may come in useful. Before the advent of the calculator, people either used them only when there was no alternative, consulted tables, or experimented. But it is so easy to use a calculator that it can be quicker to calculate the value you want than to look it up in tables or find it by trial and error. One area that is particularly suited to calculator work is close-up photography.

Most of these calculations can be done using a four-function calculator, but additional features such as a memory for intermediate steps, reciprocals and trigonometric functions can also be useful. The feature of *brackets*, for intermediate steps is also worth having.

There are different methods of keying in a calculation, so it is possible to describe only the fomulae used—you must be familiar with the use of your own calculator first. If you find some calculations regularly useful, it might be worth using a programmable device to save time each time you use it.

Most calculators offer far more accuracy than you can use, so simply ignore any decimal places which are surplus. Most of these calculations are fairly straightforward, but it is very easy to make a small mistake which upsets all your sums.

So if you are in any doubt, or if you get an unexpected answer, always check over your calculations again.

Image distance

The basic formula for calculating how far from the lens the image will be (v) for a given object distance (u) with a particular focal length (f) of lens is:

$$\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$$

Rearranging this, remembering that when a term changes sides in such a formula it changes sign, we get:

$$\frac{1}{v} = \frac{1}{f} - \frac{1}{u}$$

For most photography, where the object distance is large compared with the focal length, the value of 1/u becomes very small indeed, virtually zero. So the image distance is almost the same as the focal length. But suppose we wish to photograph an object just 250 mm away from a standard 50 mm lens—what will the image distance be? In other words, how far from the film must the lens be?

With the values chosen, the image distance turns out to be 62.5 mm. This is 12.5 mm greater than the normal 50 mm lens to film distance, when focusing on infinity. So to be able to focus down to 250 mm, the lens must travel this distance outwards from the film. If its focusing movement goes no further than 6 mm, say, then the lens will have to be moved a further 6.5 mm away from the camera in order to just focus on an object 250 mm away, by using an extension tube.

What will be the magnification on the film of such an object? The magnification is simply the image size divided by the object size, and these are proportional to

their distances from the lens, so magnification, m, is given by:

$$m = \frac{v}{u}$$

Combining this with the main formula gives:

$$u = f(1 + \frac{1}{m}) \text{ and } v = f(1 + m)$$

The terms in brackets must be worked out first, then multiplied by f.

Field of view

Another problem that might concern you is the coverage of the lens at a given distance, so that you can tell whether or not a given object will fit within the frame area without having to try it and see.

The maximum field of view is that across the diagonal of the object distance of 250 mm.

If you want the field of view, W, in degrees, use the equation:

$$W = 2 \times \tan^{-1}\left(\frac{k}{2v}\right)$$

The symbol '$\tan^{-1}$' means 'the angle whose tan is . . .'. This is often called *arctan*, and is in degrees. Putting the example values into this equation gives a value of 38°. When the lens is focused on infinity, so that v becomes the same as f, W has its maximum value of 47°. So the field of view of a lens reduces as it focuses closer.

Bear in mind that this calculation only gives the diagonal of the rectangular picture area—the width is much less.

Unless you are lucky enough to own an SLR, you need to make careful calculations to fill the frame with a close-up like this

the frame, k. You can find k from Pythagoras' Theorem, which can be rearranged to give:

$$k = \sqrt{(p^2 + q^2)}$$

p and q being the sides of the 35 mm format.

So for a 24 × 36 mm format, k is 43.3 mm.

The coverage of the lens is in simple proportion to the magnification, so a distance of 43.3 mm on the film becomes a measurement of $k/m = 43.3/0.25 = 173.2$ mm at

Exposure correction

When you are using an extension tube, the effective f-number and the exposure time change. Where the original lens aperture is N, the new effective aperture is N', called 'N-dash'. Then:

$$N' = N(1 + m),$$

and the new exposure time, t', is given by:

$$t' = t(1 + m)^2,$$

where t is the original exposure time.

Calculating field of view

1 The diagonal, k, is the image size and can be calculated from the length p and breadth q of the format
2 To find the angle of view you must use '$\tan$'. In any right angle triangle, the tan of an angle is simply the length of the opposite side divided by the adjacent so in the figure $\tan = a/b$
3 The field of view can be thought of as two right angle triangles, so we simply calculate the tan for one and double it. In the figure, the opposite side is half the diagonal of the film format— that is $k/2$. The adjacent side is the distance v. So, tan d, for instance is $k/2v$
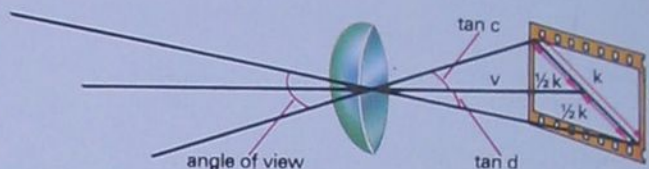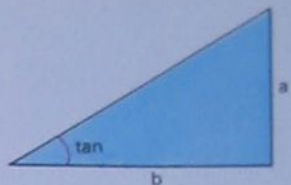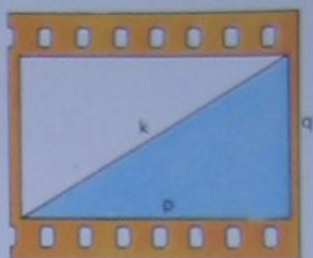
So if your exposure meter gives ¼ second at $f/8$, the new effective aperture, $N' = 8(1 + 0.25) = 10$, or $f/10$, and $t' = 0.25 (1 + 0.25)^2 = 0.4$ seconds.

This rule does not apply to telephoto or retrofocus lenses because, with these, the entrance and exit pupils have different diameters. For these you must rely on TTL metering or test shots. Depth of field calculations are covered in the next article.

Filling the frame

Once you know the angle of view, you can work out at what distance the object will fill the frame simply by dividing the diagonal of the object by the tan of the angle of view

Tessa Traeger

Tessa Traeger

With her unique and creative approach to food photography, the British photographer Tessa Traeger has shown that craft can be combined with photography in a fresh and original way

Few photographers have such a distinctive and easily recognizable style as Tessa Traeger, with her personal approach to food photography. Her skill lies not only in her photographic technique, but also the way she can create wonderful collages with the food, or construct atmospheric backgrounds. It is quite normal for her to transform a pile of fresh fruit and vegetables into an expressive face or a delicate pattern, or create a detailed, evocative setting in her own studio.

Nowadays most of Traeger's work is in advertising, particularly at home in Britain and in France, but she also does a fair amount of editorial photography as well as personal projects such as books. Although she began her photographic career doing still lifes and general editorial work, food collages have now become Tessa Traeger's signature. But she did not develop this approach until 1975 when *Vogue* magazine asked her to do their food series.

'I decided I had to come up with some new solutions. Food photography at that time was the most massive cliché—it was always exactly the same—always backlit, covered in glycerine and done on 10 × 8.

'One alternative that I chose was doing collages and the other was to construct special backgrounds for the food. It's very hard to do food photography on location. It requires going to a lot of

expense and trouble. You've got to order all the food, find a location, hire it, pay for it and then get yourself, the cook and the food there—its a fantasitic production. It's much easier to do it in your own studio. But then, of course, it's boring to do it time after time on a table top. So I compromised and decided to build little sets with background pictures and other props, so that I could tell a story in my own studio.'

Many of Tessa Traeger's pictures have a rather 19th century look. 'People often say, "Why don't you do more modern pictures?" But, you see, food isn't very

modern on the whole. If you're trying to separate the look of Russian food from that of Italian, the best thing you can do is use the old, traditional objects that you associate with those countries. That's why a modern approach to food pictures is so difficult—it can so easily look characterless and dull.

Traeger frequently uses wonderfully evocative Victorian advertising posters in her studio sets. 'My great uncle died at around the time I was starting the *Vogue* work and he had an attic full of 19th century posters and backgrounds, for Pears soap, in particular. I leapt on them

Alex Dufort

Strawberry border *photographed at Traeger's Devon studio for a 'Summer and Winter Cookbook'*

Tessa Traeger *checks a Polaroid at the Rossetti Studios— her London base*

Banquet *Created for a poster campaign for Bowyers to reinforce their traditional image. The byline read 'English families have been eating them for centuries'*

and said "I want these!" They are all well-known now but they weren't then. I like them because I think the printing is magnificent—sometimes they contain as many as eight or ten colours with tremendous depth. I think the process is called chrome lithography. They photograph very well because they have very intense colour. They are all popular, story-telling images, so they are ideal for the work I am doing.'

Although the collages that Tessa Traeger makes are very beautiful, they are also short-lived. 'I long ago decided that the charming thing with these pictures is that they are made of perishable materials. If you kept the originals and stuck them on the wall, they would soon look very sad and dreary. It's the fact that they are transient that is their charm. A lot of people say we should keep them—but you can't. The permanent thing is the photographic record. The things themselves go in the dustbin.'

She has to work fast. 'The trick is to design as much as I can before I start. But since I'm working with wet or live materials a lot of the time, I'm very much drawing as I go. For example, I did one picture with wet spaghetti. There were saucepans full of the stuff which I would dive my hands into and try to arrange then and there. You only have a few moments to take the picture.

'Each material is different, but with something like fresh herbs, the maximum time you have is a couple of hours for the whole job. Sometimes the bit you first laid down will have curled up by the time you finish, so you have to put it back again. I have got quicker at it over the years.'

Small adjustments make all the
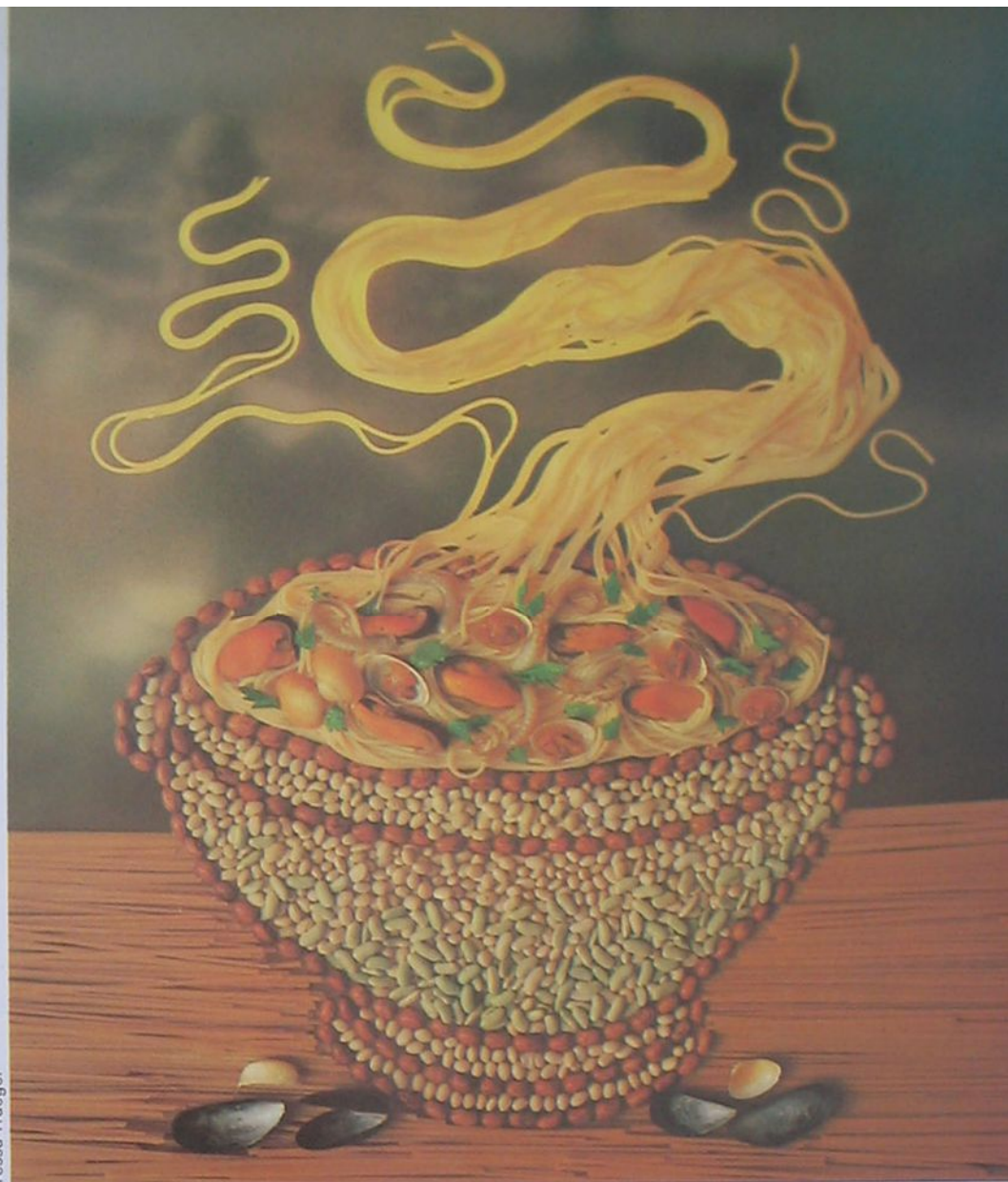
Tessa Traeger

Steaming dish *for an English 'Sunday Express' article on the five senses as pictured by five different photographers. Traeger was asked to portray smell*

difference. 'I once made a lady out of fish and I remember I made her eyes out of seaweed. If you moved them a millimetre, it totally changed her expression. You have to push it around until it looks right.'

Although Traeger's approach to food photography is highly successful, there are problems associated with this success, not the least of which is having her ideas copied by other photographers. 'I could start a second portfolio of work that people have copied—sometimes so literally that it's hard to believe. There's one fellow who's been copying my book jackets so closely that he must practically trace them'. Fortunately, few imitators are quite as blatant as this, but there are many others who will, if not copy her pictures directly, at least mimic her style.

In another instance, a French agency Tessa Traeger works for instructed another photographer to copy her style for a long-running, low budget series of advertisements for a biscuit manu-

Tessa Traeger/Young & Rubicam/Bowyers

facturer. This kind of imitation worries Traeger. Many people automatically assume it is her work. So when her imitators produce poor results, some people may mistakenly believe that the failures are Tessa Traeger's.

However, she acknowledges that everyone is inspired by other people's work. 'If I look at it positively, to be copied is the ultimate compliment.' Traeger herself drew much of her own inspiration from the Italian painter, Arcimboldo—particularly a series of paintings where fruit and other objects were arranged in the shape of people's faces.

'There's quite a tradition in painting and other arts of making up figures from other objects.' Nevertheless there is no doubt that Traeger's work is extremely original.

Tessa Traeger is luckier than most— her favourite assignment comes up once a month when she collaborates with her friend, writer Arabella Boxer, on the *Vogue* food series. This consists of an article and accompanying photograph. They choose the subject for each month together, so they can often follow up any current interests—sometimes they start with a strong visual idea, sometimes from an abstract concept. *'Vogue are* such terrific people to work for and give us total freedom to do what we like. I have worked with them for so long now, I know what they need and what the readers like. So I would never do something unsuitable or inappropriate, but at the same time we enjoy ourselves immensely.

'Whatever Arabella and I do seems to

Summer and Winter *A reversible image made from fruit and vegetables to represent each season—taken for a book based on the Vogue food series that Traeger does with Arabella Boxer and is called 'The Summer and Winter Cookbook'*

work. We prepare very thoroughly and get drenched in the subject. Each time it's a great education. Food is steeped in culture and history, so I like it as a subject. I'm not at all bored with it—the more I do, the more interest I find.

Traeger is now in the fortunate position of being offered far more work than she can handle. Yet, as she points out, there are some areas she will never be invited to explore. 'The funny thing is, it's a very sexist business, advertising, and there are tremendous prejudices. People believe that women photographers are good at food and flowers. I've never been asked to photograph hi-fi or cars and I'm sure I never will be. People get very shocked if a woman turns up on a so-called "masculine" assignment!'

She did a considerable amount of editorial work earlier in her career and is now beginning to do more again. 'This last year I have been doing much more

Sheaf of pasta composed for a booklet of recipes based around the four seasons and produced as a promotion for a French company which manufactures pasta

La Petite Auberge
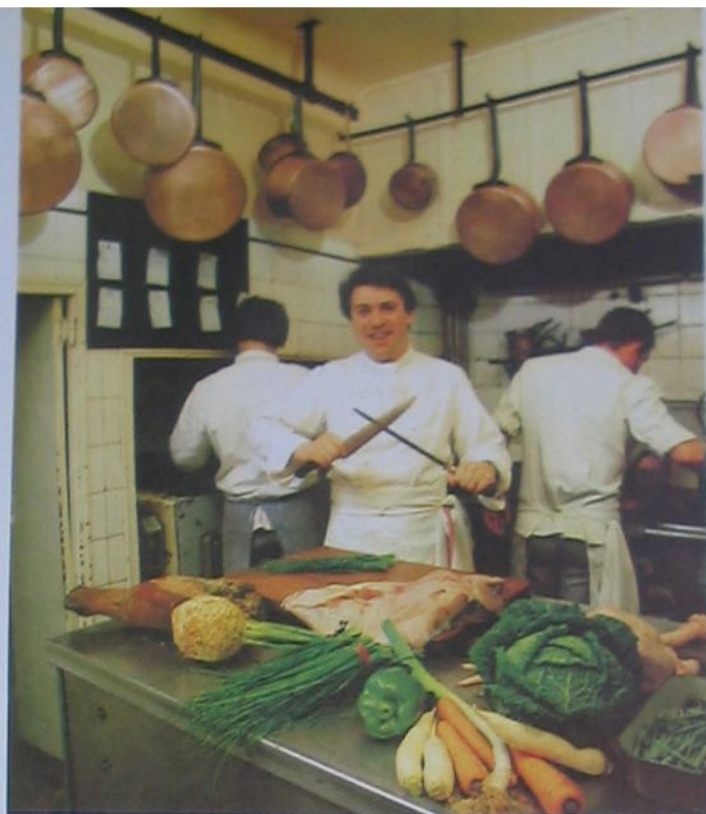Jean-Luc Barnabet in his restaurant at Vaux, photographed for a 'Sunday Times' article about 'Three star meals for one star prices'. Traeger used a Mamiya RB67 and a flash

Take-away food
Terry Stratton painted the paper cloth with bright splashes of colour and Traeger decorated it with disposable cutlery and plates to show the delights of cheap and cheerful eating
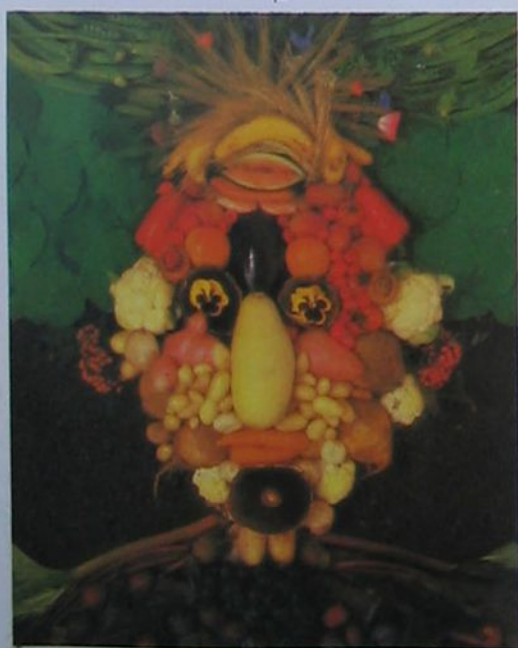
Bowl of fruit *Taken for a 'Vogue' food feature about cooking with citrus fruit. The art of arrangement is often crucial to the success of Traeger's images*

work outside the studio, partly for the *Sunday Times* and partly for *Vogue*. I'm doing a series on the opera for *Vogue* at the moment and I did an assignment on book binding before that. I've also done quite a few stories for the *Sunday Times* which include straightforward portraits.'

One of these stories, which involved photographing French chefs at work in their kitchens, she rates as her second most favourite assignment. 'In human terms it was a marvellous experience as they're all people who are very good at what they do. Once they started to appreciate that we were fellow professionals, things went smoothly. At first they were a bit resistant to a photographer being in the kitchen while they were doing their job. But I learnt to keep on the side and take pictures without interfering with the flow of work.

'They were all family restaurants—one star French country restaurants—and there's an amazing tradition of excellence, which, I'm sorry to say, doesn't exist in Britain. We learnt a great deal about food—new ways of presenting it and of thinking about it.'

Tessa Traeger's equipment reflects the varied kinds of work she does. She has three different formats of camera and hires others when she needs them. Much

Telephone ordering *This giant collage was photographed for a 48 sheet poster to publicize a mail order food company in the Paris Metro*
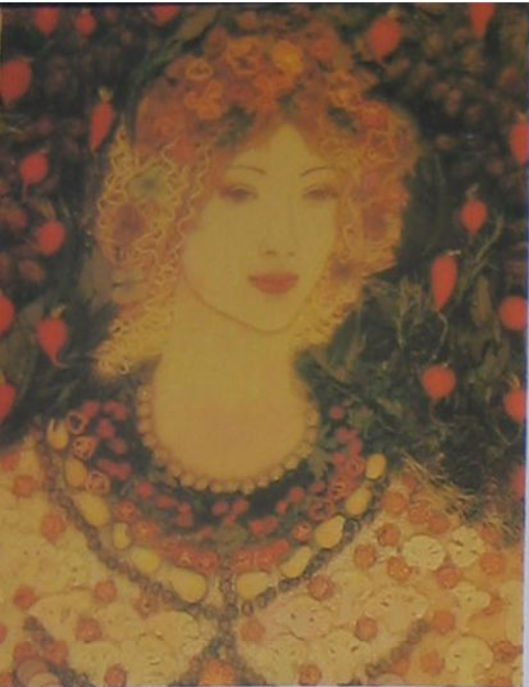
Botticelli's Primavera *constructed from entirely edible ingredients for an article on health and beauty for 'Vogue'. Food colouring was painted on a marzipan face*

Cooking with lamb *Traeger used one of her uncle's old posters for the background but had to be careful that the lambs in the picture did not appear too lifelike*

of her still life work is done on a 5 × 4 she has had since she was a student. 'It's an old MPP press camera and I just like it! I use it a lot in daylight and it's very stable. Since I do a lot of flat copy work with long exposures, having a camera which fits steadily on the tripod and doesn't waver around is very, very important.' She attaches the camera to a balcony in her studio and works from there, with the collages immediately below on a large, white Formica table.

She also has a 35 mm Nikon which she has had for years. 'I'm very happy and comfortable with it'—and a more recently acquired 6 × 7 Mamiya that she uses for portraits. On many assignments she will use all three formats, and she may work in 10 × 8 occasionally when the printing process demands a large negative.

With all these formats, Traeger uses a variety of film. 'With the Nikon I use Ektachrome 64, and with the 5 × 4 I use daylight or tungsten Ektachrome converted to daylight. I also shoot colour negative film for prints because when I come to do colour prints it's a tremendous help if you've taken a negative at the time. Then you don't have to have an interneg made and you get a print that's 10 times better.'

Polaroids are an important working tool. 'The sort of work I do is quite like drawing, and Polaroids to me are quite like sketches of work in progress. They are desperately important. I've got to be able to see what I'm doing, look at it and decide whether it's working or not. I use both colour and black and white. In fact, I use the black and white negatives too.

They're very good. I fix them and use them to print from.'

She always has one full time assistant and many other people who work with her on a freelance basis. 'I use a picture researcher, outside help to do the books, several people who cook for me, a regular stylist and, of course, I have my agents, Derek Harman in London and Istvan Varga in Paris. When we get very busy, we have a second assistant in. Generally speaking , these are my old ex-assistants. Once, last Christmas, when we had a very big job on, there were five generations of past assistants all working here. It was great fun.'

As well as building up an extensive library of photographs, both from trips abroad and work in England, Tessa Traeger has held several exhibitions of her work and some of her photographs are now in public collections.

'I'm quite proud of the fact that while carrying out my work as a professional photographer, I come up with images which actually end up in national museums. For instance, after my show in Paris, the Bibliothéque Nationale asked me to present a collection of my work for the French National Archives.

Traeger's attitude to photography is direct and realistic. 'I don't think it matters what you're doing it for; it's the quality of the end product which counts. You can do your masterpieces for an advertisement, for a magazine, or for yourself—all that matters is that it is good. People who set out to create 'art' photographs very often don't. It is much better to simply do your best. If someone in 30 years time decides it's art, then you know you've done well.'

For the moment, then, Traeger is content to remain a photographer—artistic acclaim can wait. But there is no doubt that her reputation as a photographer will long outlast the wonderful creations that it depends upon.
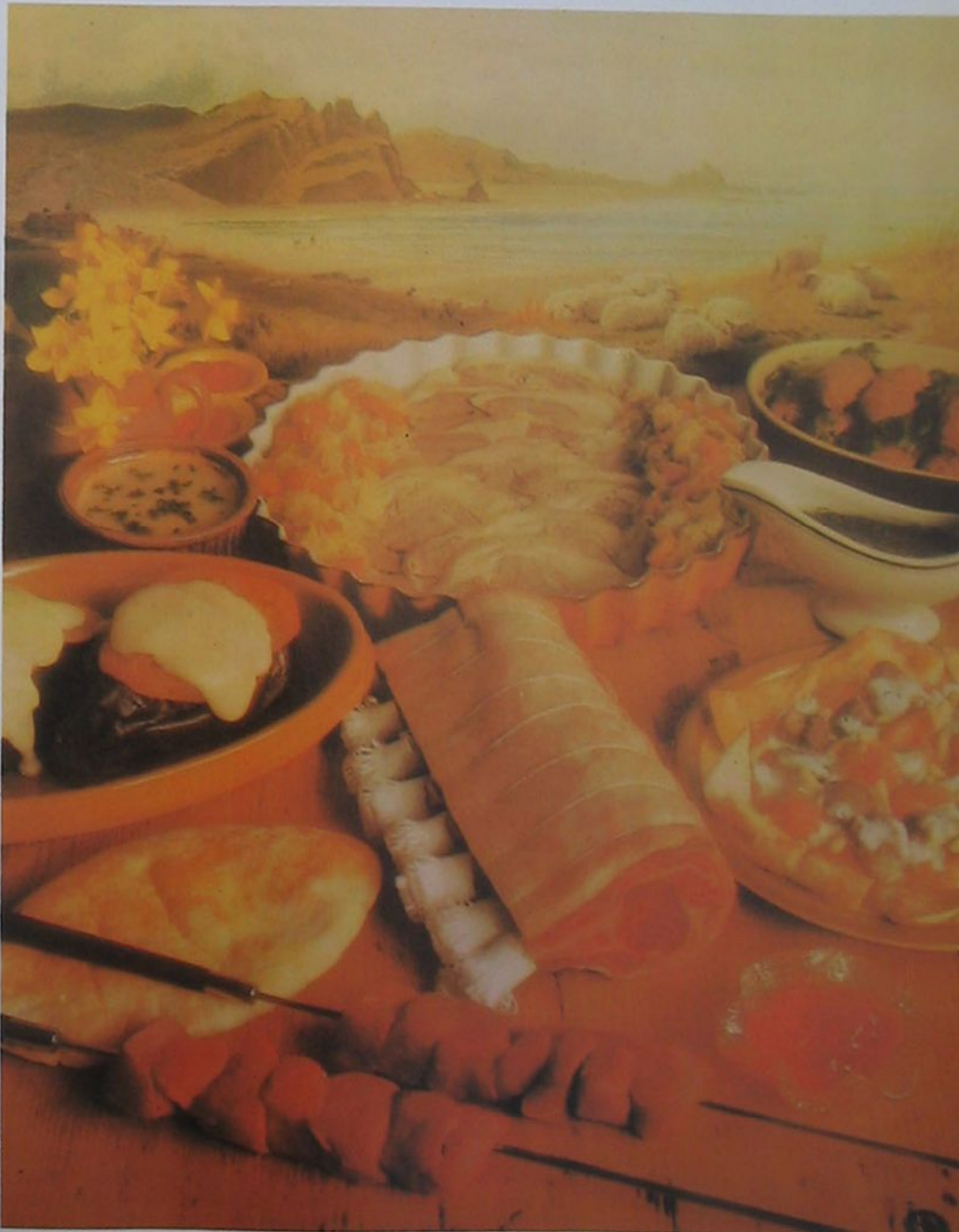
Filters for effect

There is an enormous variety of 'special effects' filters on the market. Some are very effective and easy to use; others are little more than novelty items. Just what can you get for your money?

Most amateurs are familiar with the use of filters to modify a light source or to achieve faithful rendition of colours. Also intended for the amateur market are filters for special effects, ranging in complexity from simple coloration, through selective magnification to distortion of the image. Before you attempt to use these, it is best to know what effect they give and how easily it is achieved.

Special effects filters are available separately or in kits, and vary in price according to the construction. In the Cokin range, for example, a coloured diffuser costs less than a plastic lens cap, and a 'diffraction universe' costs about the same as a 36 exposure roll of Kodachrome. For about four times as much you can buy a Hoyarex starter kit, complete with Hoya filters and acces-

sories for attaching them to the camera lens.

The basis of the various special effects filter systems is a filter holder, which is attached to the camera lens by an adapter ring that screws into the filter thread. A range of adapters is supplied with some filter systems, but with others you must ensure you buy the correct adapter for your lens.

Filters are slotted into the holder in grooves, which vary in distance from the front of the lens. Filters from one system will not fit into a holder from another system, so it is a good idea to decide on one make only.

Some filters are no more than a shape cut out of black cardboard to form a mask. You can make these simply, to your own design, but the effect is

Filter kits *include a range of basic filters and accessories—some of which are not strictly necessary*

probably not worth the effort. Most special effect filters are outside the scope of the do-it-yourself enthusiast, but you can appreciate the effects better by studying how the filters work.

Probably the most sophisticated filters work by diffraction. These are gratings made from high quality optical glass ruled with parallel lines in one or more directions—they give a star or coloured spot effect. Easily the most creative filters are the Coloured Vaseline and Coloured Varnishes, with which a wide range of coloured effects can be achieved. But they can be a little difficult to handle.
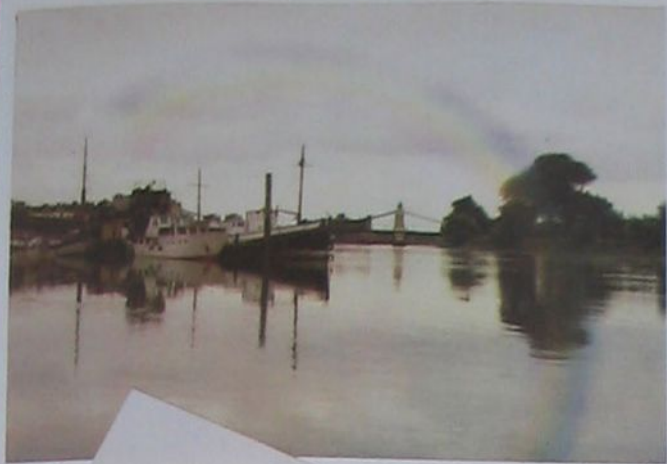
The rainbow effect is most prominent when this type of subject (a bright sky and reflective water surface) is underexposed. At the correct exposure, the rainbow is 'washed out'. In a real rainbow, the colours occur in the reverse order
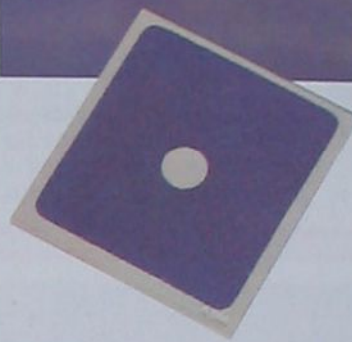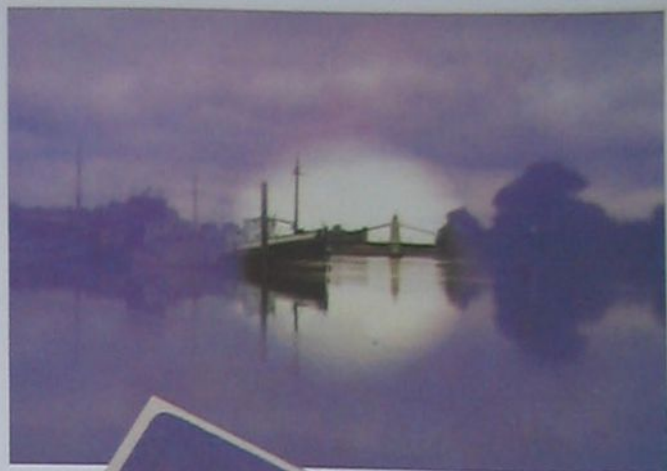
Spot in violet Essentially this is a diffuser with a clear central spot. There is a choice of several different colours, and the filter can be combined with others, such as a starburst. Focusing through the filter can be a problem

A split field filter is merely half a lens in a mount, used as a close-up lens for half the field of view. The edge of the lens causes blurring, and the non-uniform magnification causes distortion, as can be seen in the upper shot

Coloured diffuser This is supplied as two squares of crumpled plastic, which vary in colour according to the angle of view you use. Shown above are shots with and without the filter

All filtered images by John Sims

Spot in plain diffuser *This is particularly suitable for combining with coloured filters of various densities*

Dreams *The effect varies enormously according to the aperture used and the filter to lens distance*
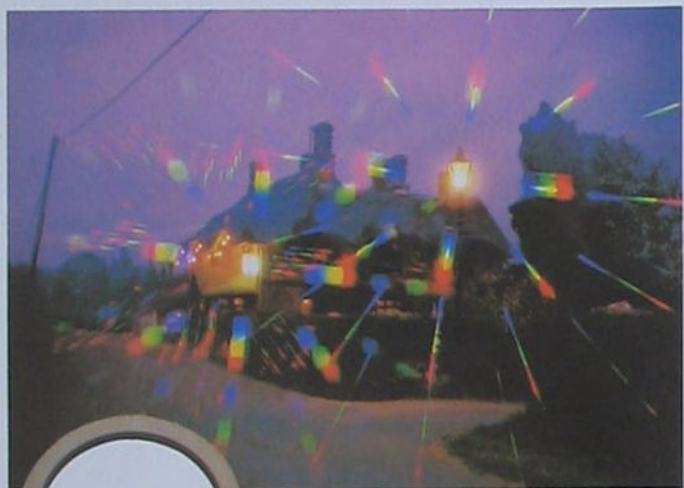
Diffraction universe *These are plain in appearance, but are in fact extremely fine gratings of various designs*

Coloured varnish, *smeared on to glass, gives a varied effect. Here it is used to tint the night sky*
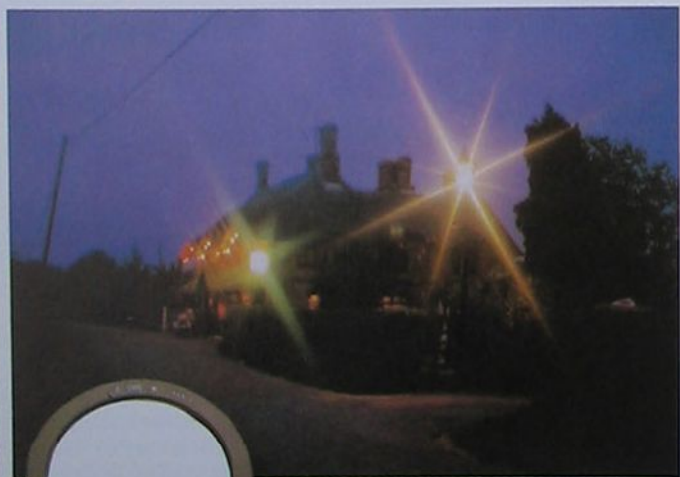
Starburst *filters for point light sources—available for two, four, eight or 16 rays*

Masks *come in a variety of shapes, but you can easily make them yourself*

Diffuser *This gives a soft focus effect, the degree of which depends on the grade of the filter*

A graduated diffuser *leaves part of the image sharp, so it is easily combined with other coloured filters*

Coloured vaseline, *smeared on to glass, allows you to filter areas of the picture just as you wish*

Fog filters *are similar to diffusers. Their effect varies according to the density of the coating on each filter*

Linear slit *This is probably the most difficult filter to use (see page 1400) but the easiest to make yourself. Results depend on how smoothly you wind the film*

Half tone screens

The principles of half-tone screening are employed in every sphere of publishing for reproducing photographs in print. You can do the same—and make your own screens—to produce low cost 'camera-ready artwork'

Half-tone screening is a method of converting the continuous tones of varying darkness in a photograph into a form which enables it to be reproduced by mechanical printing processes. These tones, in the printed image, are usually reproduced by dots of varying sizes—familiar to anyone who has taken a close look at illustrations such as those used here. The dots are formed by copying the original through and in contact with a special screen which converts the light and dark tones into small and large dots of uniform blackness. The negative that results can then be used to print screened positives.

Although used principally in publishing and graphic arts, half-tone screening is a valuable and creative darkroom skill which has many potential uses. For instance, you can prepare a publicity photograph for 'instant' printing or publication by a small society or group. Ordinary photographs reproduced in this way appear very contrasty with no mid tones, and blotchy as well—not unlike those you get from some types of office copier. But by using a screened

Instant printing *Half-tone screening enables a photograph to be used even in low cost newsletters and circulars*

Tessa Musgrave
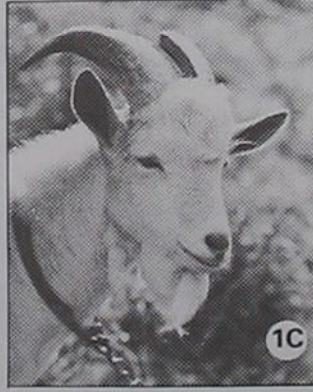
Screen sizes 1A, B and C are screenings of 26, 33 and 52 dots per cm. 2A, B and C are the same pictures reproduced on instant print showing varying dot size

copy photograph of the original print or slide, the image can be shot *dot for dot* to reproduce the all-important mid tones.

From a creative point of view, screened photographs have an obvious graphic quality with exactly the attributes and limitations of print-texture screening (see page 1236) except that you work to a screened film image rather than print image. In addition, the screen dots are vignetted rather than of constant density.

Screen choice

A half-tone screen is a 'photographic' image of, usually, a mesh of parallel lines ruled at right angles—but other screen patterns are available for special effects, and some of these are shown here. Thus a screen is usually described by its function—'half-tone' and 'mezzotint' describes two effects—and, where relevant, by its screen *ruling*, the number of lines or dots in each centimetre or inch.

It is important to choose the proper

Geoff Winkley

1A 1B 1C

2A 2B 2C

Geoff Winkley

Screen choice *A variety of commercially available screens, all enlarged from the original scale (approximately 39 dots/cm)*

ruling for a particular job. A coarse screen which yields a pattern of large dots may be needed if the image is being reproduced on rough or absorbent paper—or if you want a coarse effect. A fine screen, which gives an image composed of many more small dots, is better for reproducing detail and subtle tone—but must be properly printed, on good quality paper, or the print will be blotchy.

Newspapers make use of half-tone screens with a ruling of 85 lines per inch/33 lines per centimetre (written here in the style 85/33), but 100/39 is sometimes used. Magazine and books use 120/47, 133/52 or finer rulings. A typical range of rulings is 55/21, 65/26, 85/33, 100/39, 120/47, 133/52 and 150/59. These are available in many sizes, some as small as 25 × 20 cm but often much larger. These screens are not normally available through photo dealers, but can be obtained from specialist graphic arts suppliers. Even at the smallest size, reckon on paying the equivalent cost of a box of 100 sheets A4 b & w paper.

If you are producing images to be reproduced dot for dot on, for instance, an instant print machine, choose a fairly coarse screen—85/33 or 100/39 should

prove adequate as there is an inevitable loss of quality. The finest dots tend to disappear whereas dense areas tend to fill in. To prevent this, larger dots should be present on the first print so that, after reproduction—with its inherent increase of contrast—the image will appear correct. If the subsequent dot for dot reproduction is to be by conventional litho, you could use a 120/47 screen.

Another factor to influence your choice of screen ruling is whether or not the screened print you are producing is to be reproduced dot for dot at the same size. It is common to make originals like artwork somewhat larger than the size they are to be reproduced—in some cases simply for the artist's convenience, in others to help conceal very minor working flaws such as retouching. If the screened photograph you are producing is to be incorporated within artwork which is, for example, half as large again as the intended reproduction size (commonly referred to as 'half up'), and you intend to have a final screen size of about 100/39, you should start with the coarser 65/26 screen.

And this applies equally to the final screened print. If the screened copy negative made from the original is

enlarged or reduced—that is, printed using an enlarger rather than by contact—the screen size of the final image may in effect be very different from that actually used.

If you are having your work reproduced by conventional litho printing, it would be a good idea to get the printer to 'strip in'—combine—your screened negative with the line negative of the type and artwork. You would then only need a screen to match the desired dot ruling size on reproduction, and you would not have to make a positive screened print.

Screens have either grey or magenta dots. Both are suitable for black and white originals but only grey dot screens can be used also with colour. However, the magenta type of screen offers improved sharpness and fine detail, better tone rendering and—by use of an appropriate filter—one additional method of image contrast control.

As a final alternative, consider using Kodalith Autoscreen. This is a high contrast orthochromatic film which incorporates a half-tone screen pattern of 133/52 ruling. Half-tone negatives or positives can be prepared by contact printing—or directly in the camera—without the use of a conventional screen. Available in boxes of 25 sheets, in sizes 20.3 × 25.4 cm and 27.9 × 35.6, Autoscreen costs three to four times as much as similarly-sized colour paper.

Using screens

It is useful to look at how screened images are produced professionally to spotlight the restrictions and problem areas which occur in amateur working. The trade uses a *process camera* which can handle originals of virtually any size—even a small one could manage artwork a metre square, and film of more than A4 size. Larger units are horizontal, with the original arranged vertically in one room, the film section in another, and the lens section between the two.

Focusing is by a system of gears and pulleys on a ground glass screen which hinges out of the way to be replaced by a *vacuum easel*. This holds the dot screen

Making your own screen

Although it is much simpler to buy commercial half-tone screens, it is often cheaper to make your own. And if you make your own you have tremendous scope to create a wide variety of textures.

To make your own screen, you need some suitable material to provide the pattern. For a conventional screen, this could be the non vignetted texture screens sold as negatives for darkroom work and as dry transfers for graphic art. For a more unusual effect, you could use net curtains or even rice grains.

The pattern is copied on film by contact printing, but to produce the vignetted effect you should defocus the pattern by separating the pattern from the copy film with a clean sheet of glass. By varying the distance or diameter of the light you can control the amount of vignetting. For coarse originals, such as rice grains, you may need to rotate the light in a spiral pattern to vignette.

If the density range is correct, the gaps on the vignetted screen should be virtually clear and the dense parts of the pattern moderately dense. If the dense parts are too pale, you will find that the pattern has little affect on the image. Aim to make them slightly denser than the densest parts of the negative.

Your original may be taken from dry transfer texture screens, or anything that gives an even, regular pattern

The contact screen is made by copying on to tone film, defocusing the image slightly to produce the vignetting

Print through the contact screen on to lith film to convert the original into letter thicknesses for this effect

perfectly flat against the sheet of process film it covers.

An amateur does not of course have these facilities on quite such a grand scale—but can use an enlarger in one of two ways. As a process camera, the enlarger can be used to copy an original on the baseboard using standard copying techniques (see pages 944 to 947, and 1121 to 1123). The film is placed behind—on top—of the screen during copying. Although the directness of this method is appealing, you are restricted to a negative size dictated by the negative carrier and enlarger lens.

One way round the problem is to make use of a finer screen and then subsequently enlarge the screened negative to make a positive suitable for dot for dot reproduction.

The second method is to project the original on to a screen-film sandwich. Again, the screen should be nearest the lens and have its emulsion side in contact with the film emulsion. To ensure good contact—vital for good dot quality—use a sponge mat and black paper backing weighed down by a sheet of clean glass placed on top of the screen.

For black and white originals, ordinary orthochromatic lith material is used for the negative. If the original is in colour, you should use panchromatic lith film or produce an intermediate tone-correct black and white positive, unless some tone distortion is permissable.

It is important to use fresh lith developer when processing negatives otherwise dot quality suffers. The lith film is developed normally, usually to a set time somewhere between two and three minutes, depending on the maker's recommendations. Stick to one time, say

Correct flash *exposure is essential for good contrast (centre)—too much exposure gives a washed out image (right); too little gives excessive contrast (left)*

Geoff Winkley
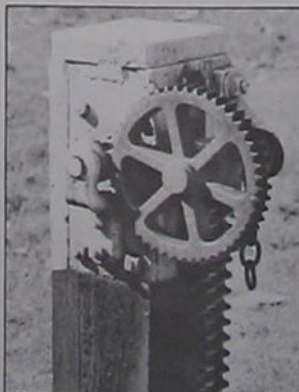
2¼ minutes, and adjust exposure to give properly graded negatives with this time. Stick to precisely the same method of agitation for all subsequent negatives—a period of *still development* is often recommended for the time remaining after the image first appears.

If you are likely to do a lot of screen work, you may find it worthwhile to buy a reflection or transmission step wedge (see page 2238). This can be included just out of the picture area and used for direct comparison of contrast and density—and simply trimmed away subsequently.

Inspect the processed negative using a fairly powerful magnifier (×10)—the dots should have hard, smooth edges and no 'whiskery' outlines. Very tiny dots should appear in the lightest areas of the negative image—corresponding with the shadows of the original—and heavy dots should appear in the darker areas—the highlights of the original.

The next stage is simply to make a positive by contact printing or enlargement. This positive is often called a *bromide* in the printing trade. Use high contrast paper for clean dots.

Process camera *This shows a professional set-up where the operator is 'sizing up', in the film room, the image of the original artwork projected by the process camera from the adjacent room*

Contrast control

More likely than not, some form of contrast control will be necessary to get an adequate range of shadow and highlight detail to reproduce. By simply varying the amount of exposure, all you do is alter the exposure threshold of the lith film negative—the more exposure you give, greater is the loss of highlight detail. In a typical reproduction, highlight and middle tones are considered more important than the shadows, and so expose for these.

Contrast may be controlled by one or a combination of methods—by controlled *flashing*, by *highlight exposure*, by filtering (magenta screen only), and by controlled agitation during development.

Controlled flashing—a relative term as exposures are measured in seconds—involves making a main exposure of the original through the screen, as normal. This can be preceded or followed by a second exposure to nothing but non image forming white or, preferably, yellow light. The main exposure is dependent on the required highlight detail. The additional exposure 'boosts' shadow detail in order to produce a satisfactory shadow dot, but also adds to the highlights.

If you are copying from the easel, simply replace the original print with a sheet of white card to make the flash exposure. Give about ten per cent of the

main exposure, if necessary stopping down the enlarger lens to give a workable exposure time.

If you are using the projection method, remove the original from the negative carrier after the main exposure. Again, try a flash exposure of about ten per cent that of the main one—but use this figure only as a starting point.

Inspect your negative to see whether the amount of shadow detail—the small dots in light areas of the negative—are sufficient. As the flash exposure adds also to the highlight areas, make sure that these do not block out in the process.

In the highlight exposure method, the screen itself is removed prior to a second exposure, this time of the original, to strongly yellow light—so can only be used in the projection copy method, and then only if the negative and original remain exactly in their former positions.

If you are using a magenta screen, various proportions of yellow, white and magenta coloured light can be used as the exposing light to alter contrast. Yellow light tends to lower contrast whereas, at the other extreme, magenta tends to increase it. The filter method is particularly useful when it is important to retain shadow detail. But exposure can be very long—and the controlled flash and highlight methods do tend to reproduce highlights more accurately.
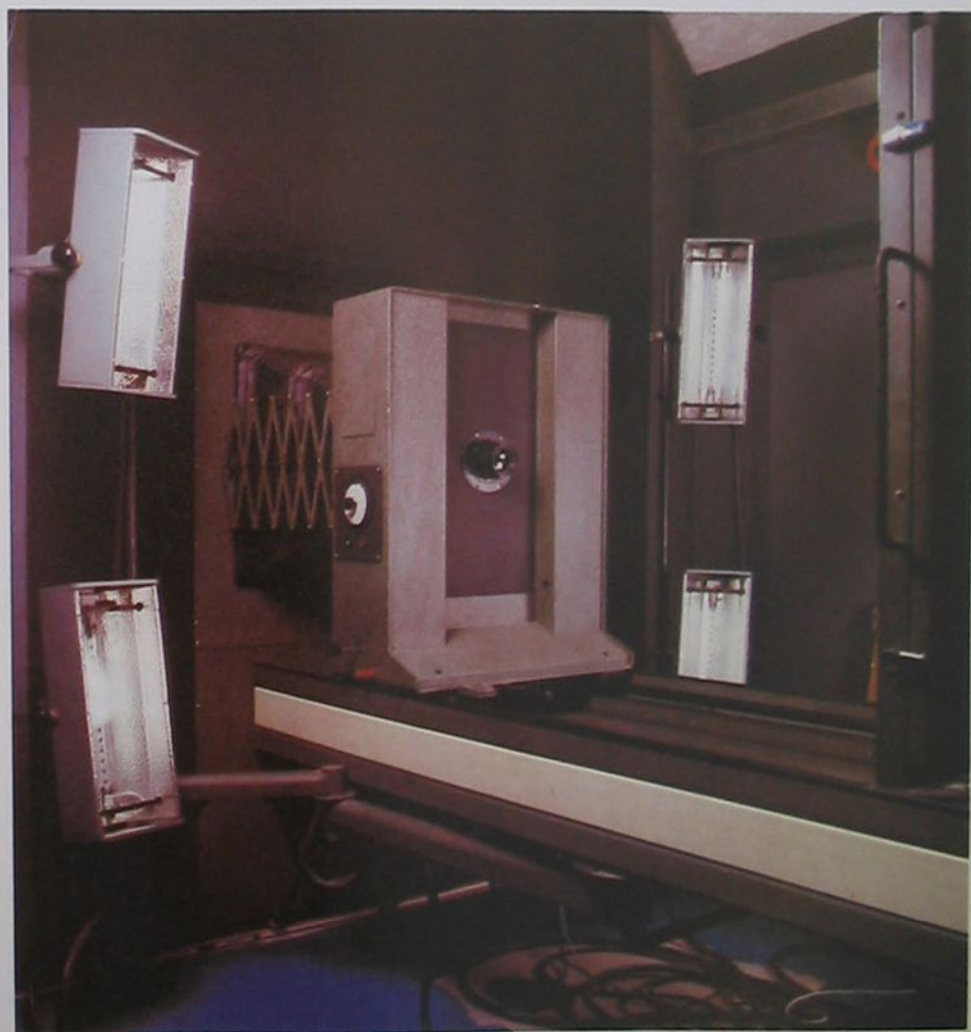
En route

Every time you drive along a country road you pass potential photographic subjects. Colin Molyneux shows that often if you concentrate on a limited area you can make something out of even the most unlikely stretch of road

Often one of the main problems facing a photographer is narrowing down a wide ranging subject to just a few photographs. However, the discipline of deliberately opting for a limited subject can be a very stimulating exercise. It teaches you to look harder for pictures—often creating attractive images in places where you would normally not bother.

To ilustrate what can be done in an exercise of this sort, we asked professional photographer Colin Molyneux to shoot a set of pictures all taken along a stretch of ordinary road—

Roadside house *For this shot, Colin used a 24 mm lens to emphasize the sweep of the bend and include more of the setting*

Winding road *A 300 mm lens provided the strong composition, but Colin had to wait an hour for the right light*

Kerbside beauty *A 55 mm Micro Nikkor allowed Colin to isolate small details like these roadside wild flowers*

Road markings *The compression of a 500 mm lens created this shot, the kind of subject few would notice*
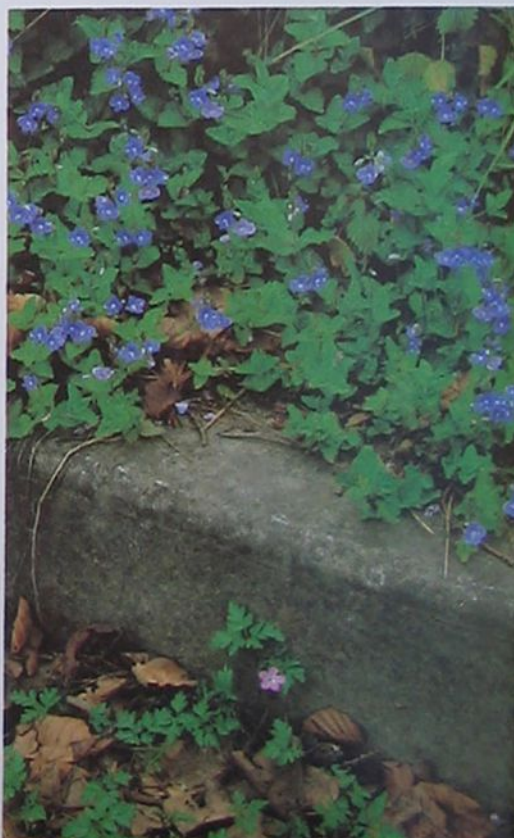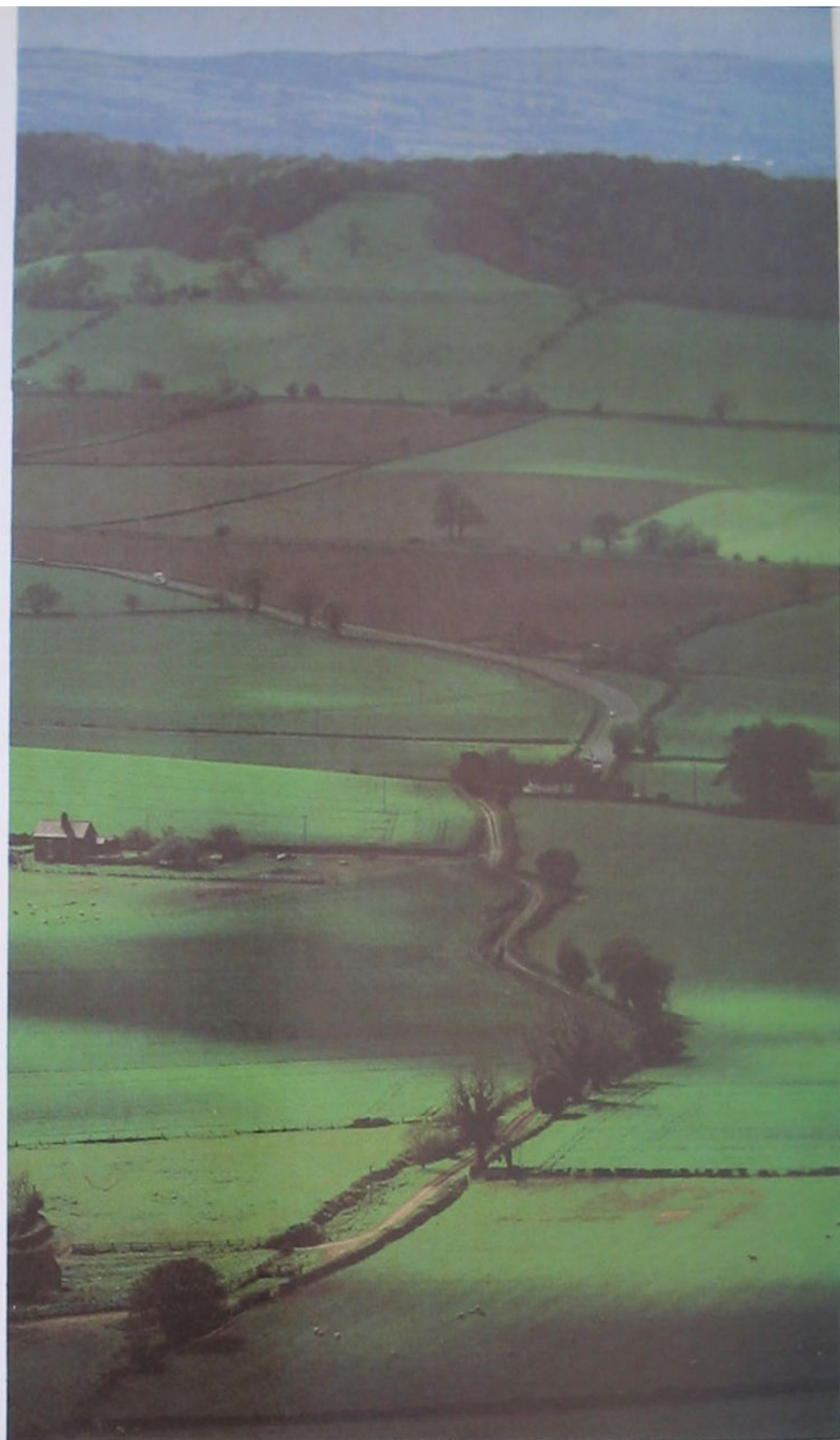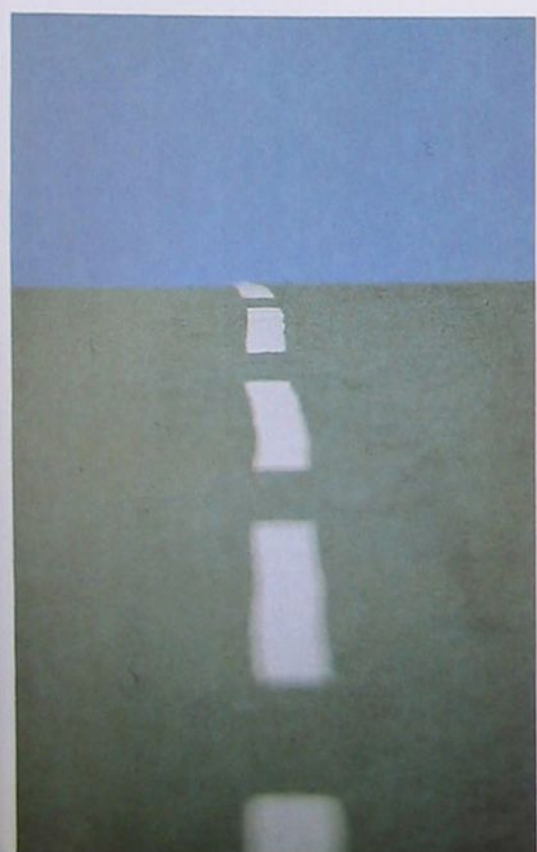
in most cases actually featuring the road itself in each shot.

An assignment like this is hard for any photographer. Colin noticed plenty of things to photograph looking away from the road, but he knew that these were not part of the brief—they would have made the exercise too easy. The degree of difficulty also varied greatly with the weather and the light, as Colin pointed out, 'On some days you can drive past an area of countryside and nothing catches your attention. But once in a while you can pass by the same place when the light is perfect—everything looks like it would make a good photograph.'

Unfortunately Colin was not so lucky with the light on the particular day he photographed this assignment. Only once during the day did the light bring the area to life—the rest of the time the light was flat and dull, making it even harder to find things to photograph.

Making the most of the characteristics of different focal length lenses is one way of finding a variety of images out of a limited location. The stretch of road was only a few kilometres long, but Colin found several places to use his 300 mm or 500 mm telephotos, exploiting their

2419

Assignment

Passing car *To add a little colour to the series, Colin composed a shot with the flowers and waited for a passing car*

The tractor *was parked right by the road and just demanded a photo. Colin framed vertically to emphasize the strong uprights*

Town street *for the shot of the village, the compression of a telephoto zoom (80–200 mm) made a tight, interesting shot*

Colin Molyneux

ability to isolate details and their compression of perspective. On the other hand, looking for good close-up subjects for use with his 55 macro lens or for subjects suited to wide angle coverage all helped to vary the images Colin produced.

But having a range of lenses at your disposal can never take the place of having an eye for a subject and the technique to make the most of it. The more Colin looked around, the more he noticed things to photograph. His patience also paid off—the shot of the road winding across the landscape was the result of noticing a good viewpoint and then waiting around for over an hour until the light changed and Colin's hopes for a good photograph were justified. It is only when you work this closely on a subject that you start to notice shots such as these.

What went wrong?

Corners

Corners of rooms or buildings appear quite often in photographs—they have an atmospheric feel. John Sims analyzes the composition of four corner shots

This photograph describes quite well the attractive and simple designs on adjacent walls of this small square. Despite the fact that one wall is well lit by a low sun and the other is in shadow, the contrast range is not too great for the transparency film used. I would avoid the temptation to photograph when the light falls more evenly on both of the walls, assuming that this does happen, since this would introduce the greater distraction of the tables, chairs and people presently in the shadow area. One small improvement to the composition overall would be to move in slightly closer in order to remove some of the unnecessary foreground
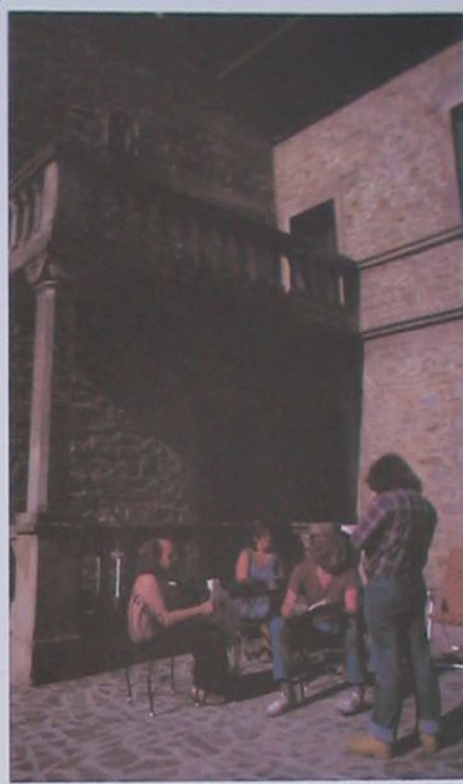
I find it very difficult to decide exactly why this photograph was taken in the first place. It is definitely not a group portrait: one of the group has his back to the camera and the others are looking at something occuring outside the right-hand side of the frame. Even had this little distraction — or attraction — been included in the picture, the photograph would still not have worked because two of the visible faces are substantially in shadow. Indeed, they have their backs to the low angled, contrasty light, Of the four people in the picture only one, the woman, is clearly recognizable
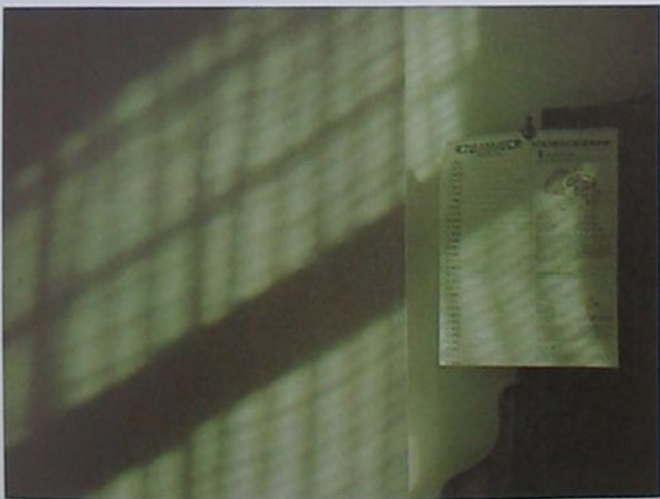
This photograph provides a good example of an attempt to use shadows to good effect by creating an interesting, semi-abstract pattern. On the evidence it is difficult to judge whether a stronger and more emphatic use of the calendar could have been achieved by moving in much closer and by using a wider lens.

The green cast, caused by reflected light from a lawn or similar expanse of green vegetation outside the window, is to my mind distracting. It could be removed partially with an 81A filter or completely with a magenta fluorescent-to-daylight type correction filter.

The impact of such a picture depends very much on your own personal taste in photography.

Here is a photograph of the interior of a small room, probably a kitchen in a Greek holiday villa. Perhaps it is the villa in the example above. Since, to my mind, there is not one feature in itself of great visual interest, I would have introduced a person into the picture. This person can then be used to create a link with the room either in a complementary way, say by using the Greek owner of the villa, or one of the Western, bikini-clad holiday-makers as a contrast. This device would also impart a time element into the photograph—traditional and static versus modern and temporary

Henri Cartier-Bresson

Henri Cartier-Bresson/Magnum

With a supreme talent for combining art and information in one telling shot, Cartier-Bresson is recognized by photographers and the public alike as the most influential master of photography in the twentieth century

Few photographers manage to achieve fame in their own lifetimes, especially outside the small world of photography. But one man, Henri Cartier-Bresson, has done more than that. Both he and his pictures have achieved an almost legendary status. And his approach to photography, that of the discreet camera capturing 'the decisive moment', has been taken up by countless photographers, amateur and professional.

To most people, Cartier-Bresson *is* his pictures. Since the 1930s, when he first took photography up seriously, he has carefully maintained a personal anonymity. While his pictures became well-known and instantly recognizable, he hid behind his Leica. And even when his photos were being exhibited and published in books and magazines all over the world he refused to be photographed himself so that he could continue to photograph unnoticed.

Nowadays, Cartier-Bresson is widely regarded as one of the world's greatest photographers but his painting and drawing is still more important than his

Alicante, *Spain, 1932*

photography. To him, photography is a special way of sketching—an attitude which is not very surprising in someone who was trained as a painter. For two years, in 1927–8, he worked in the studio of the French Cubist painter, Andre Lhote.

Cartier-Bresson has always retained his interest in drawing and, in recent years he has returned to drawing and painting, only taking photographs for his own pleasure. Nevertheless, he still regards photography as the best way of simply recording a scene. 'In my opinion, there is a common point of departure for both drawing and photography: the act of looking. But from then on they diverge: drawing is an elaboration on reality, whereas photography, for me, is an intuition, a supreme moment captured with a single shot.'

Cartier-Bresson's interest in photography started in his childhood when he was given an early Box Brownie. Then, influenced by Atget's pictures, he

started using a large format camera, which had a lens cap for a shutter. He did not use one of the revolutionary new miniature cameras (see page 2324) until 1931 when, at the age of 22, he took a small camera made by the French firm Krauss on a trip to Africa.

It was in 1932, while convalescing in Marseilles from the blackwater fever he had contracted in Africa, that Cartier-Bresson discovered the camera which was virtually to become his trademark: 'I had just discovered the Leica. It became the extension of my eye, and I have never been separated from it since I found it. I prowled the streets all day, feeling very strung up and ready to pounce, determined to "trap" life—to preserve life in the act of living.'

Cartier-Bresson immediately became a prolific photographer, and had his first major exhibition in the same year. He also started to travel again and in 1935 went to the USA. While he was there he met the photographer Paul Strand who taught him the basics of film making. Movies had been a childhood passion

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Seville, *Spain, 1933*

Colette *and her companion, 1946*

and have remained important to him. When he returned to France the following year he worked for the 'Realist' film maker Jean Renoir as a second assistant director, but he was involved not with the photography, but with the script and direction.

The experience was to prove useful later when he made his own documentary films—on hospitals in the Spanish Civil War, homecoming French POWs (*Le Retour,* 1944); and, for CBS, on California (1970) and Mississippi (1971).

The fact that he chose to make documentary rather than narrative films is significant. His whole approach to photography is that of the observer. He has travelled all over the world, most notably in Asia and North America to document other peoples and cultures;

but his best known pictures are always those that show people carrying on with their everyday lives. It is the way he captures these essentially mundane moments and turns them into something worth looking at that is at the heart of his photography. In his introduction to *The Decisive Moment* Cartier-Bresson summarizes this: 'I craved to seize the whole essence, in the confines of one single photograph, of some situation that was in the process of unrolling itself before my eyes.'

The concept of capturing the 'essence' of a scene in one picture led to an idea which has become irrevocably linked with Cartier-Bresson—that of the 'decisive moment'. This comes from a passage in the memoirs of Cardinal de Retz—'There is nothing in this world

which hasn't a decisive moment'. Cartier-Bresson first used it in 1952 as the title for a book of his pictures and it has since passed into common photographic language.

The phrase is usually taken to mean the moment when a camera has frozen the action so that the resulting image not only displays a strong composition but also produces a strong reaction in the viewer to the image's meaning and mood. In the introduction to this book Cartier-Bresson also wrote, '. . . inside movement there is one moment at which the elements in motion are in balance. Photography must seize upon this moment and hold immobile the equilibrium of it.'

There are times when Cartier-Bresson seems to regret ever having used this term. The range of his work is wide and includes portraits and landscapes. Although most of the pictures show one moment from a constantly changing scene, there are many which do not contain any such obviously frozen actions. So it is wrong to see all of Cartier-Bresson's photographs in the light of this term. Even when a moment is captured, it need not be an unrepeatable moment lasting a split second.

Instead, the pictures should be seen as

personal observations of the world. Cartier-Bresson's main concern is to make an image immediate. He aims, he says, 'to use a camera like the arrow in Herrigel's book *Zen and the Art of Archery*,' to strike the viewer with a sharp observation. He feels a need to witness the world for himself and for others, and this is why his work is most often seen in magazines, newspapers and books rather than exhibitions. In the late 1940s, Cartier-Bresson met a number of other photographers who shared these ideals—Robert Capa, David Seymour (Chim) and George Rodger. Together they formed the photographic cooperative Magnum (see page 112) with the aim of concentrating on picture stories for the new illustrated magazines like *Life*, and having a distribution agency for their photographs.

During his long career, Cartier-Bresson has photographed many important events. Some of his most famous photoessays include pictures of China during the last few months of the Nationalist Government and the first few months of the People's Republic. He was also the first photographer to visit the USSR after international relations were restored in 1954. Even so, he seems uneasy when the terms 'documentary photographer' and 'photojournalist' are applied to him.

'Journalism is a way of noting well, but while some journalists are wonderful

Hyères, *France, 1932*

Trafalgar Square, *London, on George VI's coronation day, 1938*

On the banks of the Marne, *France, 1938*
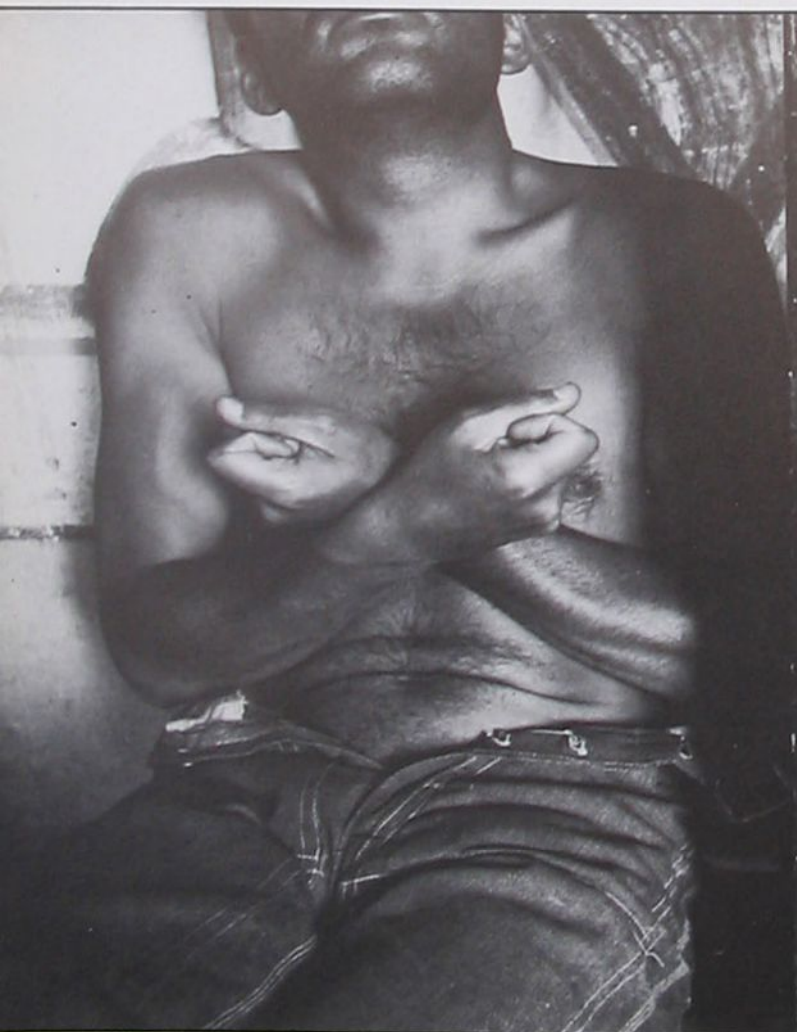
Italy, *1965 (right)*

writers, others are just putting facts one after the other. And facts are not interesting. It's a point of view on facts which is important.'

This attitude has not prevented him from producing some stunning and important documents. Nor has it stopped the journalistic world from honouring him. He has been awarded the US Overseas Press Club Award four times—in 1948 for his coverage of the death of Ghandi and in 1954, 1960 and 1964 for the best reportage of the year on Russia, China and Cuba respectively.

Much of the value of his pictures derives from the fact that he seems to be able to move around unnoticed by his subjects. Even when people are looking directly into the camera, there is still a feeling that this is how they always look, and that their attitudes have not been altered by the presence of the photographer. He achieves this by trying to concentrate with his eyes and forget himself, so that he is never trying to prove anything to anyone.

In order to observe while being unobserved himself, Cartier-Bresson has developed his technique so that the operation of the camera is like a natural reflex, and equipment is kept to a minimum. As he says, 'the actual handling of the camera . . . should be as automatic as the changing of gears in an automobile.'

He often uses just one Leica M3 camera. Indeed the essential Cartier-Bresson equipment is a single camera

Mexico, *1934 (left)*

Gestapo informer recognized *by a woman she had denounced, deportation camp, Dessau, Germany, 1945*

India, *1947 (above)*

Funeral *of a Kabuki actor, Japan, 1965*

recognize and understand a subject—
are far more important.

Cartier-Bresson works intuitively.
Although his pictures display strong,
strict and at times dramatic composition,
they are never consciously constructed.
'At the moment of shooting, composition
can stem only from our intuition, for we
are out to capture the fugitive moment.'

The basic approach is that of the
snapshot, but his shots are given strength
by the way that everything in them
seems to be in exactly the right place.
When he is shooting picture stories he

with a single lens, hidden under his coat
until needed. His favourite is the 50 mm,
but he occasionally uses 35 and 90 mm
lenses, and he has covered all the shiny
parts of his cameras and lenses with tape
to make them less obtrusive.

He now photographs exclusively in
black and white. In recent years he has
used Tri-X which he bulk loads himself
into Leica cassettes. This is developed in
Microdol and printed, on Ilford paper,
by Pierre Gassman laboratories in Paris.

Because of his experience he hardly
ever needs to use a light meter, which in
any case would slow him down and make
his presence more obvious. He uses
depth of field carefully, even though he
cannot see the depth he is getting
through the camera's viewfinder. Many
of his pictures feature a large depth of
field reminiscent of the 'deep focus'
movie photography of Jean Renoir.

Nevertheless, to Cartier-Bresson,
technique and equipment are simply a
means to an end. The photographer's
instincts and vision—the ability to

Henri Cartier-Bresson/Magnum

tries to find one shot which contains all the elements of that story, all the meaning which he is trying to express. This means that the whole creative effort is concentrated at the moment of taking the picture.

For this reason he feels that if a designer crops his pictures it is not only unnecessary but actually undesirable: 'If you start cutting or cropping a good photograph, it means death to the geometrically correct interplay of proportions. Besides, it very rarely happens that a photograph which was

Bank officer and secretary, *New York, 1960*
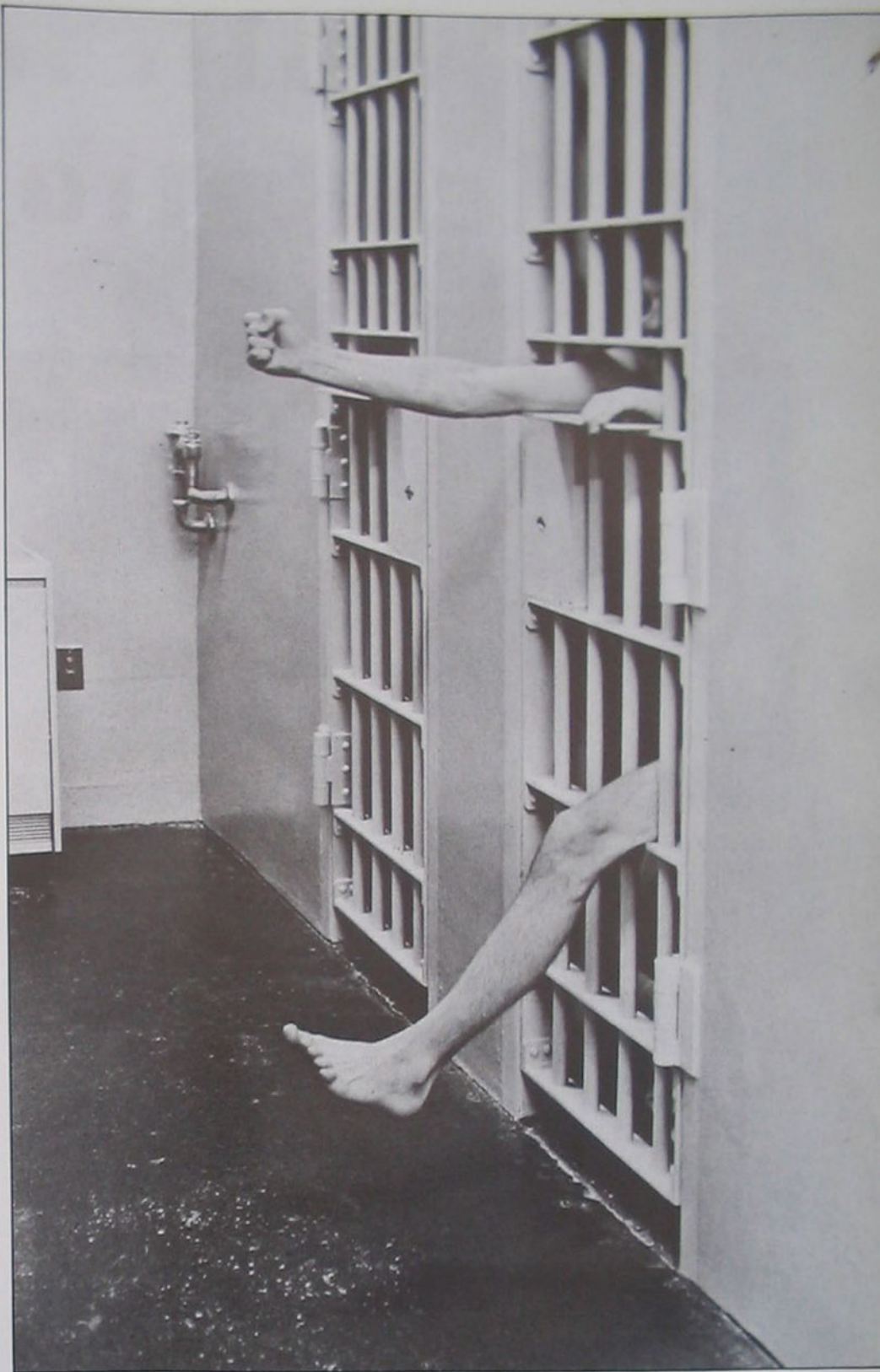
Cell of a model prison, *United States, 1975*

feebly composed can be saved by reconstruction of its composition under the darkroom's enlarger: the integrity of vision is no longer there.' If, at the time of pressing the shutter button, he feels that the shot was not right, Cartier-Bresson tries to correct it with the next one.

Cartier-Bresson's approach is one of realism. He nearly always shoots from normal eye-level as this is the viewpoint from which we are used to seeing the world. For the same reason most of his pictures are taken with available light. He wants to show the world as he finds it,

not creating himself but recording what is being created in front of him.

'We photo-reporters are people who supply information to a world in haste... We work in terms of reality, not fiction, and must therefore "discover", not fabricate.'

Additional quotations from: *The Decisive Moment* (Simon and Schuster, 1957) and *The World of Cartier-Bresson* (Thames and Hudson, 1900).

Optical calculations-2

Depth of field calculations can reveal some surprising aspects of photography—and they are easy to carry out, particularly if you have a pocket calculator or even a microcomputer to help you

Which lens?

Standard lens *It is a common myth that different lenses have different depths of field. This shot was taken using a standard lens with extension tube, at an aperture of f/16, the smallest possible, yet the butterfly is not sharp from wingtip to wingtip. Will a different focal length help to improve depth of field?*

Telephoto lens *A 135 mm lens, at the same aperture and scale, gives identical depth of field—and a wide angle would do the same. But a telephoto may stop down to f/22, giving better depth of field, and also allows you to photograph from a greater distance, avoiding scaring the butterfly away*

It is very useful to know the depth of field which your lens is giving you in any particular situation. But depth of field scales marked on lenses give only very approximate values, often omitting many of the apertures altogether. Many zoom lenses have no scales at all, and judging sharpness on a focusing screen is far from easy when the lens is stopped down because of the darkness of the image. Fortunately, it is possible to work out depth of field yourself on a pocket calculator.

The most useful type of calculator is a programmable one, as some of the values in the equations are fixed. The factors involved, which are chosen by the photographer, are the focal length of the lens (f), the effective aperture (N) and the focused distance (u). The fourth factor, the circle of confusion (C), remains fixed for a given format (see page 963). Its value is usually taken as 0.033 mm for the 35 mm and

0.05 mm for 6 × 6 cm format.

Formerly, a variable value of C was used—normally f divided by 1000—so that C varied with focal length. This, plus the fact that a fixed value of C is used now, means that there are serious discrepancies betweeen the various depth of field tables available for particular focal lengths. The advantage of working out your own tables is that you can choose your own value for C.

Once you have decided on a value for C you can use it to find values for the nearest point in focus, D_n, and the furthest point in focus, D_f, using these equations:

1) $D_n = \dfrac{uf^2}{f^2 + uCN}$

2) $D_f = \dfrac{uf^2}{f^2 - uCN}$

The depth of field, D, is given by $D = D_f - D_n$.

Some experimentation may be needed to find a suitable keying-in sequence for these equations. A calculator with three or four memories is an advantage as the various parts of the equations can be worked out separately, stored and then brought back when needed. If you do not want to know the actual values for the nearest and furthest point in focus, but simply want to know how much depth of field there is, you can use this formula:

$$D = \frac{2CNu^2}{f^2}$$

This is an equation derived from the two main ones above. It is slightly less accurate, but is useful when full calculations are unnecessary. In all these equations the units used should be consistent throughout. It is probably easiest to work in millimetres. This gives answers for D_f, D_n and D also in millimetres. In some situations this may be acceptable—for

example, when using telephoto lenses with wide apertures at close distances. But in most cases it is best to convert the final results into metres (by dividing by 1000).

Example results

Calculating a few figures for your main lenses gives you a better practical idea of depth of field. For example, a 28–85 mm zoom lens, focused at 1 m and set at f/4, gives a depth of field of 37 mm, 106 mm and 347 mm at focal length settings of 85 mm, 50 mm and 28 mm respectively. This means that the depth of field at the widest setting is nearly ten times that at 85 mm.

At the 28 mm setting and 1 m focus, altering the aperture from f/2.8 to f/16 changes the depth of field from 239 mm to 2470 mm, a ratio of 10.4 to 1. At 85 mm the range is from 26 to 147 mm, a ratio of 5.7 to 1. So it can be seen that stopping down increases depth of field more dramatically with a wide angle lens than with a

long focus one.

Some figures for depth of field can be surprisingly small at large apertures, particularly at close distances. It is possible to get an 50 mm lens which, at $f/1$ and maximum aperture and focused at 1 m gives a depth of field of only 26 mm. This means that any rangefinder or reflex focusing system must be very accurate.

For close-up work another formula is used. This is:

$$D = \frac{2CN(1 + m)}{m^2}$$

where m is the magnification. In this case the depth of field does not depend on the focal length. This means that a 50 mm lens and a 135 mm lens both focused to give a magnification of 0.5 would give the same zone of sharpness. However, the lens to subject distances would be different, giving different perspectives from the two viewpoints.

There is a complication with close-up work in that the effective aperture is often different from the set value. For example, a lens which is set up to give 1:1 reproduction (such as for slide copying work) and which is set at $f/11$, actually gives an effective aperture of $f/22$. At this magnification and aperture the depth of field for a 50 mm lens is 2.9 mm, so the original must be held very flat indeed.

From near to infinity

Another useful equation is that for hyperfocal distance (see page 962). This gives the distance, in millimetres, which you focus the lens at in order to get depth of field from half that distance to infinity—this being the greatest depth of field possible with that lens at that aperture. The equation is:

$$h = \frac{f^2}{NC}$$

where h is the hyperfocal distance. In published depth of field tables, distances over a certain amount are simply labelled 'infinity'. However, no object is actually at infinity—it is simply a term used for distances which are so great that rays of light coming from objects at those distances are so nearly parallel that any divergence

can be ignored. But the nearest distance that can be taken to be at infinity varies with focal length, circle of confusion and aperture.

For example, infinity for a 50 mm lens set at $f/2$ is at approximately 38 m, while for a 100 mm lens at the same aperture it is around 150 m. The distance for infinity increases to around 300 m for a 200 mm lens at $f/4$. For a 500 mm at $f/5.6$ it is slightly over 1.3 kilometres! Stopping down brings 'infinity' closer.

These are theoretical limits, and manufacturers who publish depth of field tables often take 'infinity' as being much closer. But when you are calculating depth of field tables it is worth bearing this aspect in mind.

Where is infinity?

Infinite tree *Calculations show that an object at 38 m—here, the nearby tree in line with the steeple—should appear sharp through this 50 mm lens working at f/2*
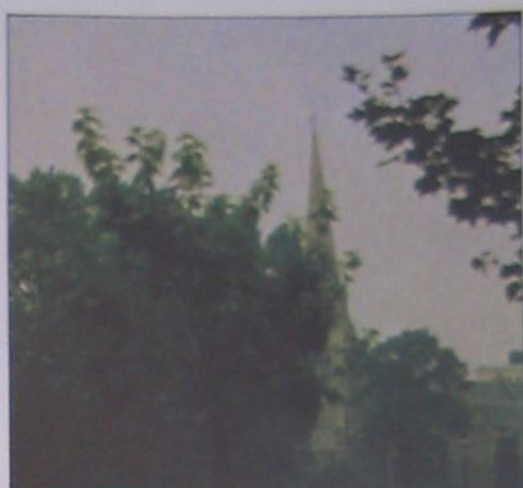
Nearer tree *Moving just 3 m closer to the tree, it appears more blurred in this 15 × enlargement. But on a smaller print, both results might be perfectly acceptable*

Changing the value of 'C'

Blurred hat *The lens was focused so that the hat, 5 m away, would just be in focus according to the depth of field scale on the lens, using an aperture of f/16. A 20 × enlargement shows that the image of the hat is not critically sharp, especially when inside the true focus*

Sharp hat *At the same aperture of f/16, the lens was refocused using the f/8 mark on the depth of field scale, thus using a more critical value of 'C'. The results are as sharp as if the lens was focusing at the correct distance, when using Ektachrome 64*

Ray Duns

2429

Oktoberfest

Fast work and basic equipment are the main requirements for success at a fast-moving event, as David Hoffman discovered when he visited the Munich Beer Festival

Each year, during the last two weeks of September, thousands of tourists flock to mix with locals at the biggest drinking session in the world. Professional photographer David Hoffman joined them to explore the photographic possibilities presented by the spectacle of thousands of people joined in a common pursuit.

Operating purely as a member of the public, David mixed with the vast crowds, working fast, shooting and moving on. He found that on the whole, people ignored his presence, more interested in their own concerns, which gave him a considerable degree of freedom.

He took along two Nikon F2 bodies and an FE along with a range of lenses from 24 mm to 200 mm. However, the need for fast action and consequent simplicity meant that almost all the shots were taken on the F2 bodies, one mounted with a 35 mm f/2 and one with a 105 mm f/2.8.

The 105 mm was particularly useful for grabbing quick candid photos while in the interior shots its wide aperture allowed for quick and accurate focusing.

David had chosen 200 ASA Ektachrome EPD as its relatively fast speed was adequate for shooting in the low light in the main beer hall while outside it allowed for the use of wide apertures, giving differential focusing on grabbed portraits. Occasionally David used a Metz 45 CT1 flash but he preferred to shoot by available light 'lurking in dark corners and trying to stay invisible.'

Occasionally David's presence aroused a certain amount of animosity: 'One man approached me rather unsteadily waving a large knife vaguely in my direction, but I pushed him to one side and he disappeared into the crowds'. Generally speaking a few conciliatory gestures and some carefully rehearsed words of German were enough to defuse tense situations.

David was at the festival during the first weekend. 'The Saturday', he says 'was a real let down—not much going on and a mizzling rain making photography difficult. On the Sunday the event sprang to life with whole villages and factories arriving, getting tipsy and having a good time.'

Dancers *For moving subjects in low light levels a fast film is essential—here 200 ASA.*

Barmaid *Rather than posing his subject, David lay in wait with a pre-focused camera and took the shot as the barmaid came into view*

David Hoffman
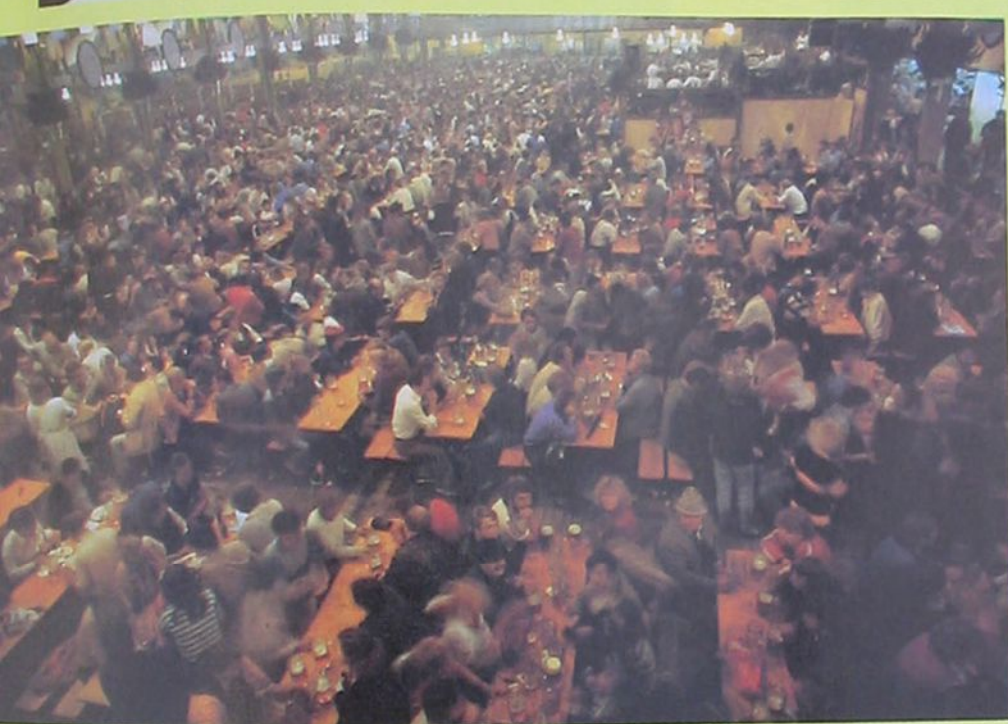
Profile *A medium telephoto allows tight framing and differential focusing to blur a distracting background.*
Float *Carnival processions offer many colourful and willing subjects.*
Main hall *David used a wide angle lens to achieve an overall view of the scene*

Some aspects of the festival presented themselves as obvious photographic subjects such as the sheer enormity of the beer hall and the Tyrollean dancers in national costume. Other shots, however, required a more searching approach.

Any event such as the Oktoberfest can be covered comprehensively with even the most basic equipment. The professional enjoys no special advantages. In fact the large selection of equipment which often gives the professional an advantage over the amateur is a positive disadvantage in a busy, milling crowd. 'The main requirements,' says David, 'are a fast eye and, on occasion, a fast tongue!'

Resting *To show all aspects of the festival David took this picture of one of its victims, contrasting with the happier shots.*
Lovers *When spotted while taking candids, David smiled to show good intent and this was enough to prevent friction*

2431

PHOTO ESSAYS

One of the most effective ways of giving a complete and rounded impression of people, places or events is to make a 'photo essay' on the subject. But to work well, the images must be carefully planned and selected
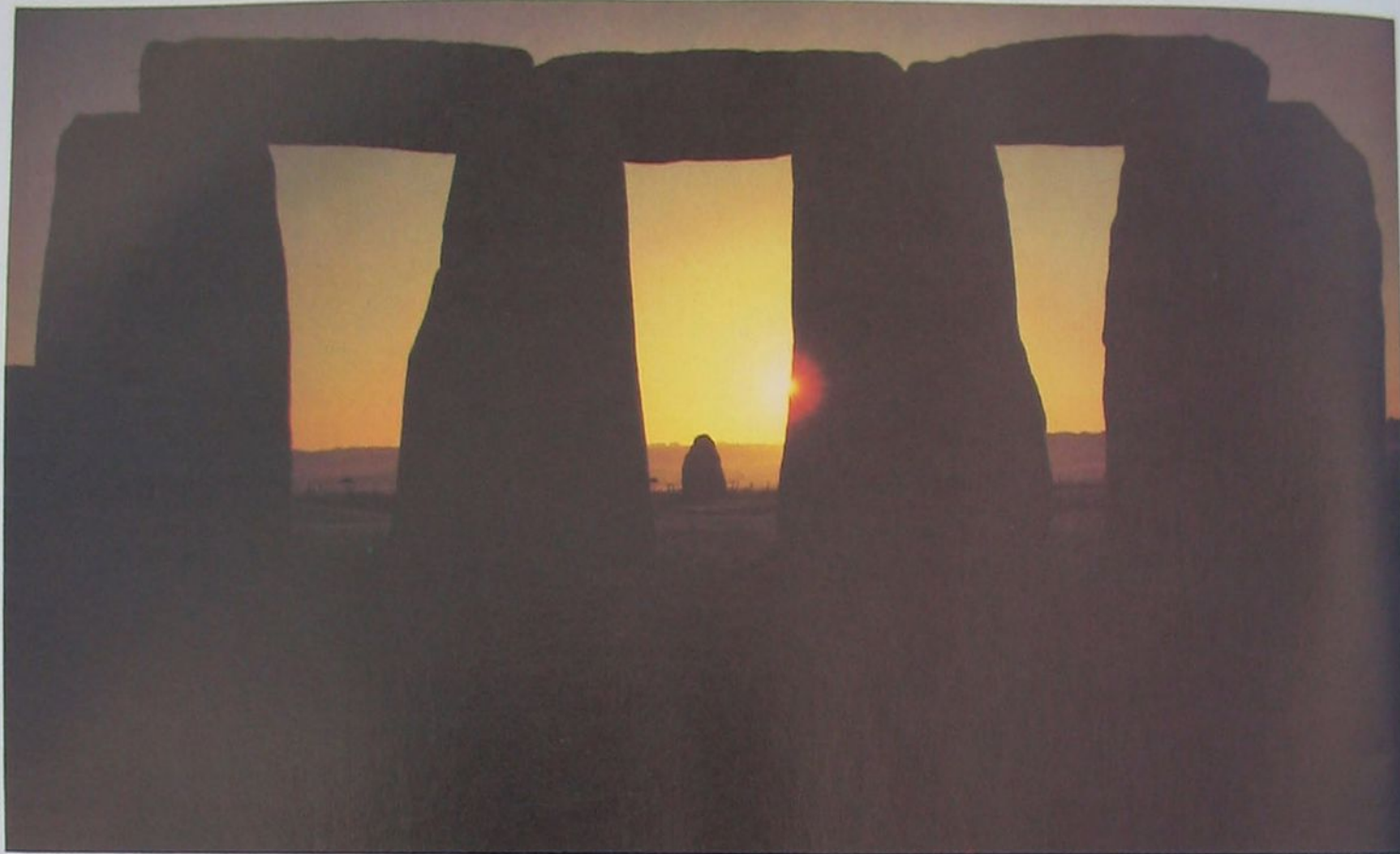
Homer Sykes

Most people think of photography in terms of single images—even though pictures are often presented in sequence, as in a slide show or in the pages of an album. In a photo essay, the pictures are designed to be combined with others, so that it is the overall effect that creates impact. This type of photography has much in common with the continuity of a movie film—the final essay, as displayed, is the unit and for a successful photo essay the sum is greater than the parts.

The photo essay was an inevitable result of using the camera for the purposes of journalism and owes its creation to the development of news magazines in the 1920s and 1930s. The idea was to cover a story with a selection of photographs, rather than to try and make one picture say everything, and this principle has remained unchanged. The approach gives the photographer the chance to explore ideas about a subject and show different aspects of it making it possible to do justice to those subjects that are too involved or diverse to be summarized neatly. Although the craft of the photo essay has been developed primarily for the big magazines, it is not the exclusive preserve of professional photographers. There are ways of displaying a set of pictures other than in a published article, and the opportunities for amateurs are every bit as good. You can display your photographs in sequence in a slide projector, or in an album, or as a group of prints hanging on a wall.

In their basic treatment of the material, there are two types of photo essay. One is narrative in its approach, and has a strong, underlying link to a storyline. The other is descriptive, and lacks the element of a sequence in time but is concerned chiefly with digging deeply into as many dimensions of a subject as possible. These two approaches are not mutually exclusive. One photo essay may have elements from each, but the choice of subject often suggests which has priority.

In the narrative style of photo essay, the pictures are shot as a sequence and used to show an event happening over a period of time. This could be something as straightforward as the way in which something is made, or it could involve
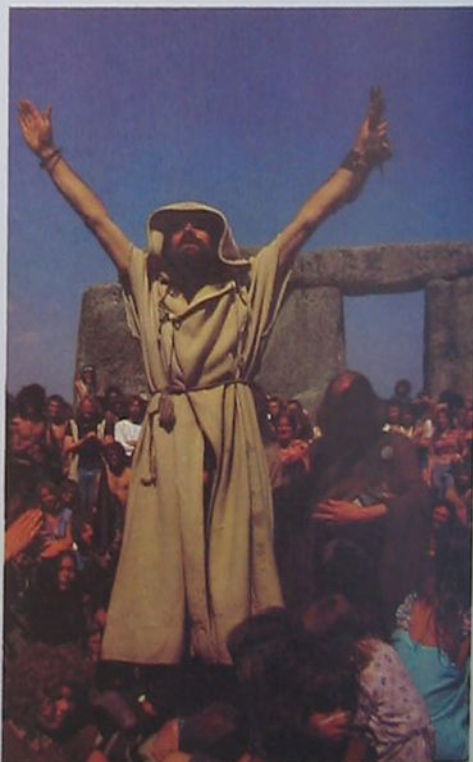
Solstice at Stonehenge *Each year the midsummer solstice is celebrated at Stonehenge by a druid ceremony attended by thousands of hippies who erect a temporary tent-city on Salisbury Plain. The story opens with a strong photo of the midsummer sun dawning over the ancient circle and then explores various aspects of the event. Druids and hippies are photographed in full regalia and a distant shot of the teepee commune adds variety and shows the size of the gathering. The druid ceremony which provides the focus for the event makes a strong closing shot*
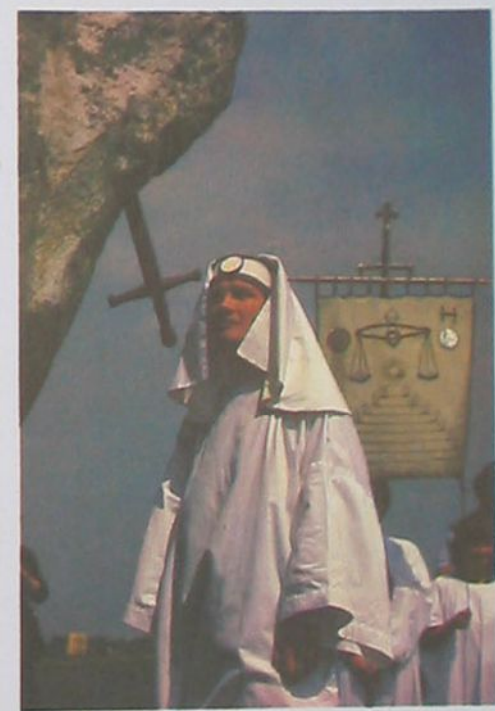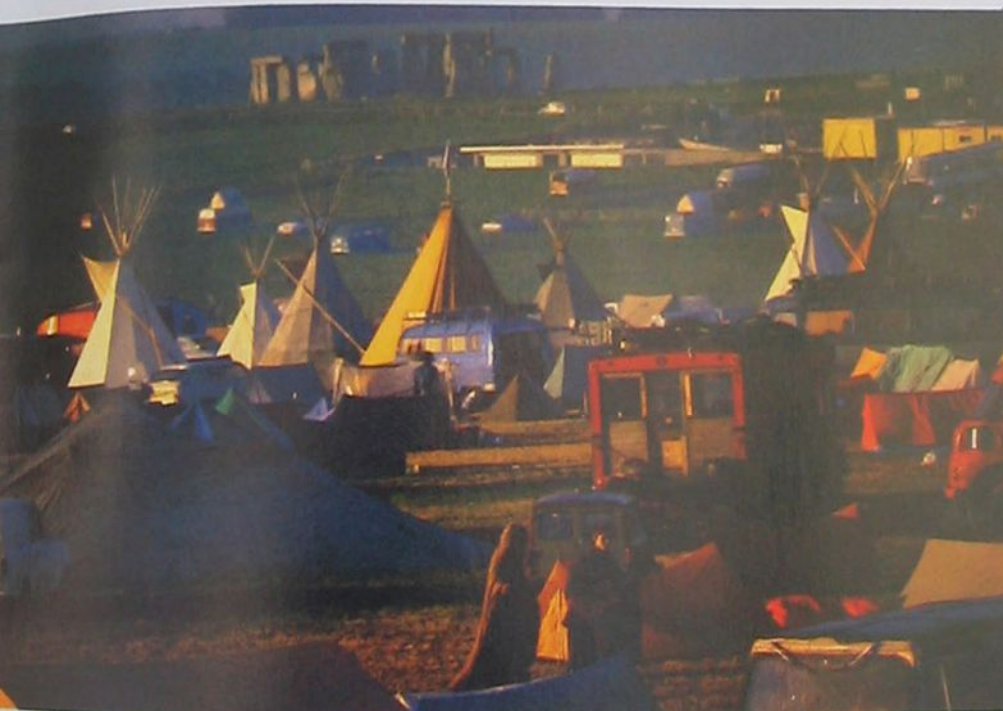
more interpretation and shooting skill, such as the preparations and build-up of events leading to a sporting event or a political rally.

Probably one of the easiest types of narrative essay to use as a starting point is a crafts sequence. Choose something to which you have reasonably easy access and that can be completed in a fairly short span of time. The making of a ceramic pot could, for example, make a very satisfactory sequence. Before you begin, find out exactly what will happen, and in how many stages. Then work out roughly how many steps you will need to photograph to make sense of the operation. This, after all, is the purpose of a narrative photo essay—to dissect the processes as clearly as possible.

With a list like this in your head, you can then work out the technical details, including lighting, lens focal length, camera position, and composition—all of which can only be decided on the merits of the particular situation. Let the action suggest the type of picture. When the craftsman has to work in great detail, such as engraving a decorative motif, move in close with a macro lens. On the other hand, when things happen on a larger scale—a pot being fired, for example—pull back to show the overall setting. There is absolutely no need to keep the camera in a fixed position for a sequence or to keep the same perspective by using the same lens all the time—sometimes this works, but more often it can be repetitive and rather dull.

Even in a straightforward documentary sequence such as this, some variety of image is important.

To progress beyond this relatively simple type of sequence, try shooting a public event that is itself highly structured. A sports match, race or march all offer more exciting but demanding possibilities. Here, the sequence is not so precisely planned and adjustable, there is often uncertainty about the outcome and actually getting to the best camera positions may take some thought and effort. In principle, however, all such events follow a similar pattern from a photographer's point of view and the function of the photo essay remains to follow a narrative pattern.

The alternative approach is the
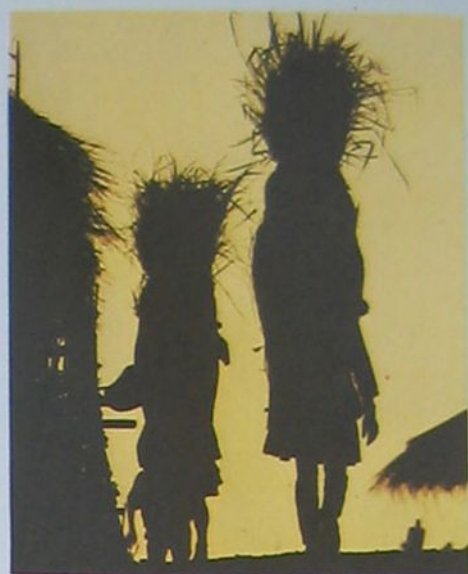
descriptive photo essay which attempts to show a subject from a number of angles rather than one which simply tells a story. The choice of subject is virtually without limit, but clearly those that benefit most from this treatment are subjects you know well enough to appreciate alternative approaches. Places, such as a town, a river or a stretch of countryside, can make good basic subjects.

One subject that is particularly well suited to this treatment is a nature essay based on a defined area that you can visit regularly—some local woodland, for example, or a section of sea shore. In this case, think of the place as a complete unit, made up of related elements like weather, plants, insect life, birds or animals. Then try to show this complexity and variety by photographing it on different scales, from full landscape to close-up detail. A similar assignment, if you are more interested in candid photography, is any regular group activity, such as people working in a factory, children at school, or families at a seaside resort. Here again, try and look at your theme from all sides and all points of view. In a classroom, for instance, you could contrast a child's view of a lesson with the teacher's by shooting over-the-shoulder photographs.

Careful research into the subject you are photographing is particularly important with a photo essay because your target is to give a general overview rather than a single insight. Although it may not be possible to plan everything in advance, preparing some of the shots gives you a core of material around which to work. As you continue with the project, new ideas may emerge, and part of the fun of working on a self-assigned photo essay is in discovering new ways of looking at one subject.

Because you need to become closely involved with your subject to produce a strong photo essay, it is especially important to plan your shots with a very clear idea of how the pictures may eventually be presented. For instance, if you were doing an essay on fairground

Michael Freeman

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of their effort on.

Variety is also essential in a photo essay and this can be achieved in two main areas: content and image. Finding variety of content is fairly straightforward—look at all the different physical properties of a subject. In the case of an essay on a school, these would include the school building, playground, classrooms, playing fields, and details that epitomize daily life such as desktops, satchels, chalk, blackboards and notice boards. Then look at the different activities—in the school sequence these could include different types of class, a teacher instructing, children reciting, writing, playing games or misbehaving in class.

For variety of image, think more about different visual treatments than about the subjects themselves. Shoot at different scales. In a nature essay, for example, include not only broad views but also extreme close-ups of the pattern of dew on a cobweb or the veins of a leaf. Also, different focal length lenses add their own character to images, from the distortion of a wide angle lens to the compressed perspective of a telephoto. These differences, which are essentially only of perspective, are also responsible for creating a sense of involvement, from the subjective sense of a wide angle to the more distancing effect of a long focus lens. Vary the composition by using both vertical and horizontal formats, perhaps even cropping the occasional picture to a very narrow shape or experimenting with composition—vary where you place the focus of interest in the frame. Use different lighting when you can—high key and low key images, diffused lighting, back lighting or spot lighting. Colours, too, can be made to provide variety, particularly if you include a few pictures that are each dominated by a

life, then even though you may be concentrating on close-ups of people and their actions, at least one overall view of the fairground would be needed to establish the context. In the same way, to make sense of a particular activity, you may have to include a shot purely for its information value, irrespective of whether it makes an exciting image. This is sometimes known as a *point picture*, and it is usually an important feature of photo essays—they need a few functional pictures among the really strong images that photographers spend most
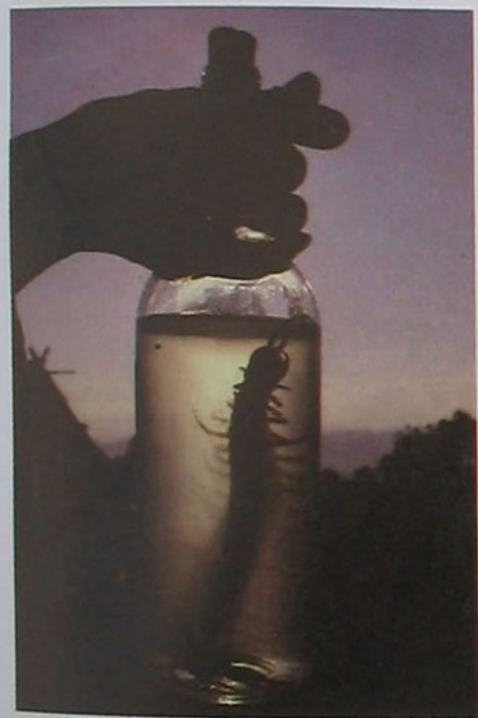
Thailand *In this photo essay, the photographer has combined shots of the location with pictures of everyday life to give a clear impression of this village in Thailand. Record shots of roof-building and cooking are balanced with images of strong visual impact such as the silhouettes of women carrying reed bundles and the atmospheric photo of a misty dawn over the village. The portrait of the pipe smoker, so proud of her fine jewellery, reminds us that this series is basically about people. The shots of the leech, reputed to have magic properties, and of the funeral procession, show how different their life is from our own very effectively*

single, different hue.

But the important point to remember about shooting a photo essay is that your coverage should be far more structured than a normal assignment. You should aim to achieve a balance between the various types of shot. If you are covering a state occasion, for instance, it is important not to overdo the candid shots of spectators around you. Remember, the event is what people want to see; the crowd shots are normally included just to provide atmosphere—unless, of course, they are the subject of your essay. Try to balance your coverage during the event as well—it is easy to feel you have done enough after shooting many pictures of the opening sequence, leaving the latter stages virtually undocumented. It is also easy to overlook the obvious key shot—a photo essay on the president's visit to your town would hardly be complete without a shot of the head of state. Always shoot more than necessary, since you can edit later.

Editing is an integral part of the
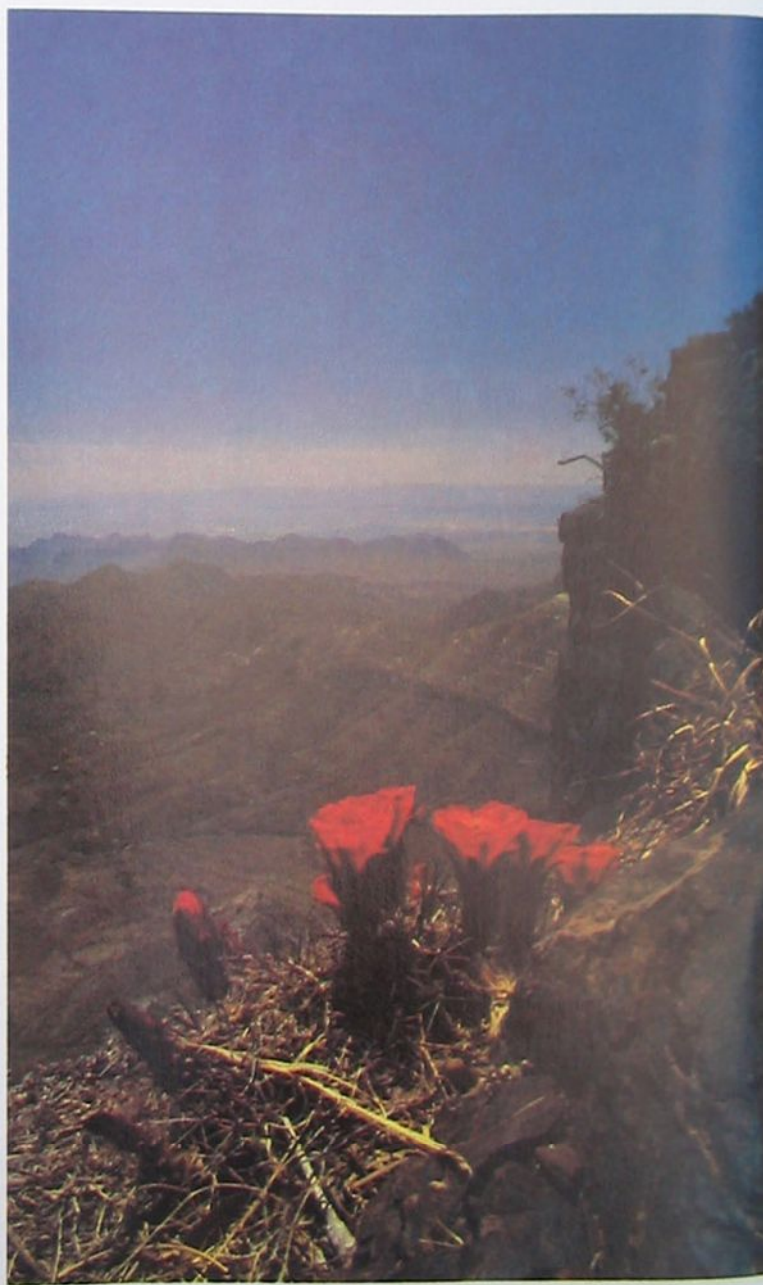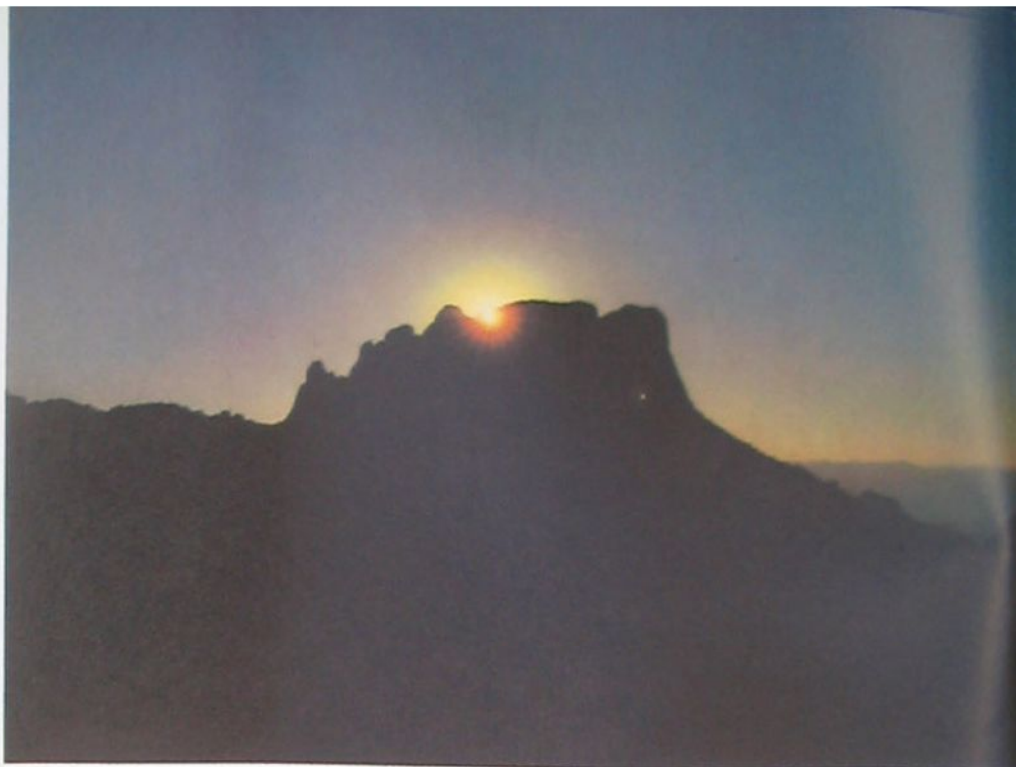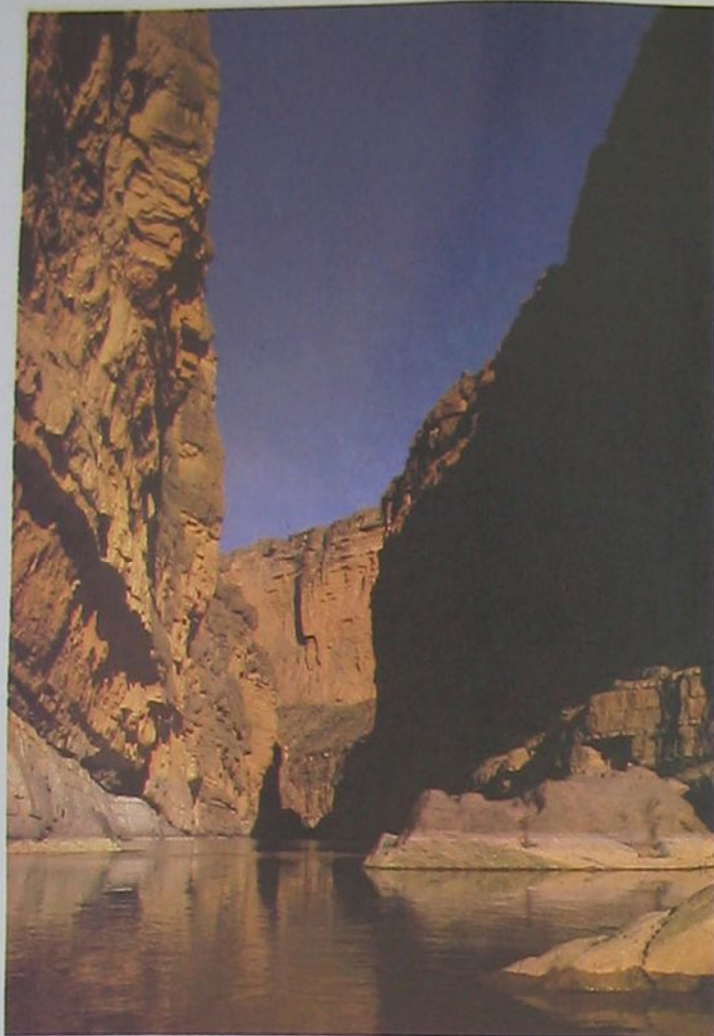
Big Bend *This sequence from Big Bend National Park, Texas, shows how a variety of approaches can help give a complete picture. The vast grandeur of the scenery is set against details of the landscape.*

In the opening shot of the essay, sunrise over the Casa Grande, detail is sacrificed for the power of a strong image. Individual features show the park on another scale; from the point of view of its inhabitants. The roadrunner bearing a courtship offering and the Western Coachwhip snake show how this inhospitable landscape is in fact teeming with life. Compare the yellow longspur columbine, a straightforward record shot, with the red cactus flowers, photographed among their surroundings

process, and this is the time when the photo essay really begins to take shape and come to life. Editing is basically a selection procedure, but for a photo essay this process goes beyond eliminating faults and choosing the best individual pictures. It involves giving a structure to the final group of photographs that are going to be displayed. If you are shooting in black and white or colour negative film, do your editing from contact sheets to save the expense of unnecessary printing. If you are using colour transparencies, lay them all out on a light box and experiment by arranging them in different orders. Naturally, there are many different ways of structuring a photo essay, but one characterstic approach is to open and close the sequence with a strong, large image.

One of the most effective creative devices in editing or presenting a group of images is juxtaposition. Setting contrasting pairs and groups of photographs next to each other can heighten contrasts or comparisons, and even make points that would not otherwise be obvious from a random selection. At a basic level, put together a pair of shots, one showing a full view of a subject, perhaps a craftsman at work— and the other a detail such as his hands. If you are making prints, one of these can be much larger than the other. The usual treatment would be to have the large view printed large and the detail small, but, occasionally it is worth printing the detail large instead. Another possibility is to assemble a large number of similar images in one block—a treatment sometimes called a mosaic. For instance, if you were doing an essay on a town, it might be effective to present a selection of door knockers all printed up together. Another way of combining several photographs is in a time sequence, to form a mini essay within the overall structure. At a sports event, for instance, a motor drive sequence of some small, limited action could be presented in a strip instead of editing.

How cameras are made

Camera manufacturing techniques are as varied as the cameras themselves, from old fashioned, hand-crafted bellows cameras to mass-produced snapshot cameras—is either method superior?

Nippon Kogaku K.K./Nikon (UK) Ltd.

The design constraints and choice of materials are crucial considerations for a camera producer. Equally important is the manufacturing process. Each component must be made to the required specification and costs. During manufacture, a component might be redesigned so it is simpler and less expensive to make: at all stages, there is a continuous feedback between design and production.

There might also be a need for production engineering, which is the business of adapting production machinery to the job in hand. In the toolroom, or the amateur workshop,

production engineering is considered only when improvization is called for. In manufacturing, where each small saving on a single unit is multiplied by the number of units made, it can be most important.

If much of a factory's machinery is not suitable for making all components, a manufacturer might contract out the work. This can range from buying in unfinished castings, through machined parts, to complete subsystems. One example of a bought-in subsystem is a camera shutter—either the traditional leaf type, or the blade shutter of the copal square type. Usually the sub-

contractor is prepared to customize the basic product so that it becomes a fully integrated part of the design: the compur of the Hasselblad is an excellent example.

The assembly of a camera from bought-in components and sub-assemblies has the advantages of little or no development and manufacturing costs, and, in the case of complete subsystems can be relied upon as a proven unit. It does mean, however, that the manufacturer pays the subcontractor's profits—this must be passed on to the customer—and also two separate inspection costs—their own and the

limited, it is still worth using die-casting for lightness and strength, despite the fact that fabrication from sheet and bar might be less expensive. And die-casting can be used for small components, such as wind-on levers, controls, and even film-drive sprockets on inexpensive cameras.

Pressed-metal housings are simple to work with: top and bottom plates, and camera backs are usually best made this way. Stamped components can be inferior—depending on their function. A stamped-out aluminium disc for a film-counter is satisfactory, but stamped gears are usually of poor quality and durability.

Only the crudest mechanisms can be made by moulding, die-casting, pressing, and stamping. For precision parts, machining is essential. Either finished or unfinished machined components can be bought-in to order, but the cost is normally prohibitive if the entire camera is to be made this way.

For limited production, manual machining might be sufficient, and the investment in specialized plant need not be high. Some small firms work on a batch basis, making a few hundred of each component in turn. This method makes for extreme versatility, but it requires a skilled hand and a versatile production staff.

Sometimes a manufacturer decides to employ specialized machine tools. The cheapest and simplest are automatic drilling machines and turret lathes. Some firms use only these, but others might install automatic milling and broaching machines for which the sums invested can be considerable.

To justify the expense of these machines, the throughput needs to be considerable. So some manufacturers avoid automation—particularly if the work can be done adequately by skilled

Production techniques *vary greatly, but few cameras are constructed totally manually. In fact, most manufacturers combine automation (for certain components and subsystems) with manual assembly by highly skilled workers. The manufacture of die-cast bodies, even to the drilling of holes and tapping of screw threads, is commonly automated (above). The assembly of subsystems, such as the shutter (left) and top plate (above), on to the body is also done on a production line basis*

subcontractor's. Furthermore, the manufacturer might have to make do with existing components that are not ideal—it was the restrictions on speed and close-focusing ability of the compur which prompted Hasselblad to design and build the 2000FC, with its focal plane shutter.

Still, with bought-in components, a specialized manufacturer may be able to offer his speciality at a remarkably low cost. A compur shutter may seem expensive, but it would probably cost three times as much if development and specialist machinery costs had not been recouped over such a long period of time and so many million units.

For some components, there may in any case be no choice. Few camera manufacturers can make their own printed circuits and electronic chips, or even mix their own plastics, and not many make their own glasses.

Component manufacture

Just as there is a hierarchy in the cost and versatility of materials, so there is one for manufacturing processes. Plastic mould-ing, for example, is cheapest, followed by die-casting and metal pressing. Next come the machining operations. In ascending order of cost, they are drilling, turning, milling, and broaching. Plastic is suitable for only certain types of applications. Where plastic is unsuitable, die-cast alloy and pressed or stamped metal are the next resort. For a camera chassis, die-casting is the only manufacturing process for light, strong, intricate shapes. Even if production is

Traditional methods *for making and testing shutter curtains at the Leitz works, West Germany, are cost effective even today. Greater sophistication is expensive, and might have little effect on quality*
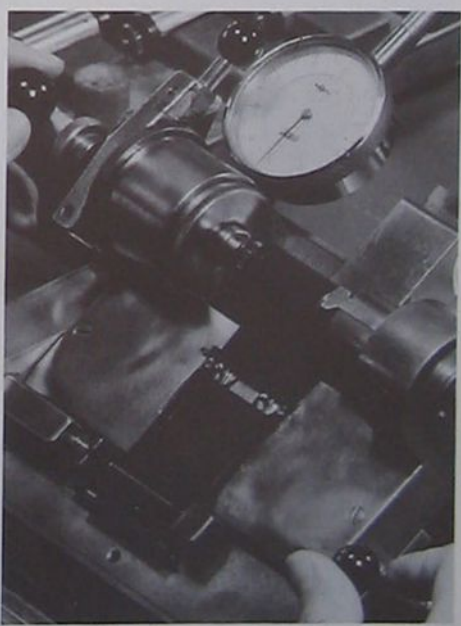
workers. This keeps capital investment to a minimum, and although the costs may be higher in the long run, at least they come in small, regular instalments every payday. For this reason, a labour-intense approach is most appropriate when labour is cheap or where the company has little money to spare.

Contrary to popular belief, machine-made components are not necessarily inferior to those made by hand. In fact, given the accuracy and repeatability of machine manufacture, they are likely to be superior. The need for manufacturers to undertake individual matching, hand fitting, and selective assembly is virtually an admission of wide component tolerances.

Assembly

At the top end of the market, hand assembly may be preferable: a component might be within tolerances, but selective assembly and a little hand-filing could make the difference between a mechanism that works well and one that works 'sweetly'. This calls for a skilled workforce with a fair idea of the whole manufacturing process, and is one of the reasons top-flight cameras work so smoothly and cost so much. Those who have not owned Leicas, Hasselblads, and Linhofs often scoff at the price: those who have had the privilege usually appreciate why they are so expensive.

A mass-produced camera can be assembled either on a manual production line or by automation. In a manual system, unskilled or semi-skilled workers each perform a simple repetitive task, working with ready-to-use components. But the need for thorough inspection of components largely offsets the low cost of unskilled labour.

Because of the need for extensive quality control with manual mass production, automatic assembly is extremely popular. Once set, a machine can produce many identical components before it goes wrong, so periodic inspection of the machine tools is all that is usually required. If manufactured parts are also assembled by machine, the possible human errors of assembly are eliminated—a machine will not attempt to install a gearwheel upside down, or forget to tighten a screw.

For certain types of operations, such as high speed processes, human inspection is impractical. Even on slower processes, there is the likelihood of boredom and inattention when so little ever goes wrong. These difficulties can be overcome by *batch inspection*, in which, say, one in ten cameras is inspected thoroughly, or automatic inspection of every camera.

Although almost every part of the mechanism can be tested automatically, some are easier to test than others. Electric components are very easily tested. A set of probes applied to the appropriate point can check both the shutter and meter. They are also easier to assemble than complicated mechanisms with gear-wheels, spindles, and escapements.

One drawback of automatic inspections is that they check only what they have been programmed for, and may miss serious faults, such as blowholes in castings, which would be obvious to a human inspector.

The most serious drawback of automatic assembly comes when the camera is to be repaired. A camera built by hand can usually be dismantled and re-assembled by hand. Built by automation, the logic and sequence of assembly are likely to be different. For example, a single touch of an automatic soldering tool can unite a dozen connections. If for repair each has to be painstakingly unsoldered and then resoldered by hand, the cost of repair will be high.

In a cheaply assembled camera (which is *not* necessarily a badly assembled camera), the cost of the components accounts for a major part of the price. The initial cost is low, too, so that the cost of repair and new components (especially if a major sub-system, such as the shutter or the electronics, is replaced) may reach an absurdly high proportion of the purchase price.

In the final analysis, there are three types of cameras: good expensive cameras, good cheap cameras, and bad cheap cameras—there are very few bad expensive cameras. A good expensive camera is built of the best materials by a first-class workforce to meet the very

Work stations *in a camera assembly hall receive components through overhead tubes, as well as partly assembled cameras, on to which sub-assemblies are fitted*

Gloved fingers *help to ensure that the camera's electronic components are not contaminated with grease and moisture while being handled during assembly*

Electronic testing *Using a meter that gives a digital readout, shutter speeds can be rapidly and reliably checked for accuracy merely by operating the camera*

highest standards and go on meeting them for a very long time. It is a delight to use, and will stand considerable abuse.

A good cheap camera will meet the needs of its customers. At the top end of the market, it may resemble the good expensive camera closely: there may be a few economies in the materials, but cost savings will come from ingenious design and highly mechanized assembly but mainly from the economies of scale associated with a vast production run. It will not run as sweetly, and it may not last as long, but it will still be a very good camera. Further down-market, the camera has fewer features and, because it will be probably used less heavily, is less robust.

A bad cheap camera economizes on materials and inspection (but seldom paper specification), and although it may work well enough for a while, it may also be a problem from the start.

Shooting the stars-1

Virtually any good camera will allow you to photoglraph many of the wonders of the heavens with nothing more than a sturdy tripod, a locking cable release and a good lens, coupled with modern films

Many people believe that pictures of such natural sky phenomena as stars and lightning require elaborate equipment, or at least some exotic film stock. In fact, it is possible to take a wide range of such pictures with an ordinary camera and film. The key to success is choosing the right combination of conditions, lens exposure time and film.

Long exposures

Among the easiest photographs to take are those which involve opening the shutter for a long exposure with the camera on a tripod. In this way you can take night pictures of lightning and star trails on a comparatively slow film—any film suitable for general photography should be quite adequate.

The classic shot of this type shows stars trailing across the sky as the Earth turns. Simply point the camera at a suitable group of stars, focus on infinity and open the shutter with the lens at full aperture. The camera must be very steadily mounted on a tripod.

An exposure time of several minutes will cause the star images to streak out into trails. The curvature of the trails depends on where in the sky you point the camera. If you aim at the celestial pole, the stars will trail in circles round the pole. If you aim at the celestial equator, however, the stars move in straight lines. Between these two extremes, the stars move in arcs.

Michael Freeman

Tropical night *An exposure time of a few minutes at f/2 on Ektachrome 400 was sufficient to add star trails to this photograph of a Thai village*

North polar trails *This is an hour's exposure with a standard lens at f/2 on Kodachrome 64 film. Compare this with the south polar view on page 1568*

Stormy weather *Lightning is easiest to photograph at night when you can open the shutter for a minute or more using slow film. Kodachrome 64 film, 30 sec. f/5.6*

Long trails *Stars near the celestial equator trail with straight lines. Long exposures make the trails longer, rather than reveal much fainter stars*

Science Photo Library

The celestial pole is located at the same altitude above the horizon as your latitude. In the UK, at about 52°N, for example, the pole is due north at 52° above the horizon. An Australian at 35°S will find the south celestial pole 35° above the horizon looking due south. The celestial equator is a great circle 90° away from these points. The star Polaris is within a degree of the north celestial pole, but there is no equivalent bright star in the southern hemisphere.

Leaving the shutter open for an hour or more will produce spectacular circular trails even on slow film. The longer you can leave the shutter open the better, but there are two snags. One is that any unwanted light in the sky may fog the film, and the other is that dew or frost may settle on the lens.

The only way to overcome the first problem is to select a very dark site. Stopping down the lens from maximum aperture will simply result in fewer trails, though the results may still be worthwhile. As a guide, you can give more than an hour's exposure on 64 ASA

film at f/2 as long as the sky is sufficiently dark that you can see the Milky Way, or you cannot read the bold type at the beginning of this article even when your eyes are well adapted to the dark. You must be well away from any large urban areas and there should be no trace of mist in the atmosphere.

Dew can settle even on mild nights when you do not expect it. It tends to accumulate on dark objects pointing at the sky, which includes the lens of a camera, long before it is noticeable anywhere else. There are several ways to combat it, the simplest being a *dew cap* of cardboard or, preferably, expanded polystyrene packing material set around the lens like a lens hood. The cap provides a pocket of warmer air in front of the lens, which is just enough to prevent dew. It should not obstruct the

Photographing constellations

Having photographed star trails, it is tempting to try to record the stars as points of light, as they really are. This is possible, but calls for more care.

Although a star trail on slow film is clearly recorded, if the exposure time is sufficiently short that the stars do not trail, very little can be seen. It is much easier to see a fine trail on a photograph than a point of light of the same size, so faster film is usually needed. With film of 200 ASA (ISO) or faster, however, it is possible to reduce the exposure time sufficiently that the trails are quite short. If you look closely you will still see that the trails are slightly elongated, but for most purposes they appear as points of light.

As a rule of thumb, using a 50 mm lens you can give an exposure time of 15 seconds for stars on the celestial equator, and slightly longer for stars in other parts of the sky, without trailing becoming objectionable. If you double the focal length, you halve the permitted

field of view of the lens you are using. If you still have your camera's packing you may be able to cut a hole just larger than your lens in the appropriate place.

There is no advantage in using a wide angle or telephoto lens for star trail photography. What is most important is the quality of the lens, and the camera's standard lens usually gives the best quality at a given aperture.

When the shutter is left open pointing at the sky for any length of time it is possible that a *meteor*—a shooting star—will cross the field of view. It is impossible to predict just where and when a meteor will appear, though they are more frequent on particular nights, so photographing one is largely a matter of luck. Meteors are harder to photograph than stars, however, as they move rapidly, so their image only affects a grain in the emulsion for a fraction of a second, rather than many seconds as in the case of a star. So only particularly bright or slow meteors will record on film. Satellites and aircraft, on the other hand, often show up on star trail photos.

Lightning

As well as astronomical objects, you may photograph lightning using similar techniques. As lightning is unpredictable, photographing infrequent strikes is a question of keeping the shutter open for a length of time in the hope that one will occur during the exposure. On a dark night, when the clouds are not illuminated by streetlights, you can keep the shutter open for many minutes, but in urban areas or when there is light in the sky exposure times are limited. But on slow film it may be possible to give exposures as long as ten seconds when the sky is very overcast if you close the lens down to its smallest aperture. Nearby lightning may still record on film, though more distant strikes, partly obscured by cloud and rain, may not. There are no definite exposure rules, as individual circumstances vary so much.

Orion *Star patterns are best shown on exposures of about 15 sec on a standard lens with 400 ASA film. Include detail in the foreground for added interest*

Ruth Bradford-Harris

exposure time. So the longest exposure you can safely give using a 200 mm lens is about four seconds. On the other hand, with a 24 mm lens you may give a 30 second exposure. Such exposure times with apertures of f/2.8 or wider and fast films will record stars fainter than the eye can see.

Only when the sky is quite bright with reflected streetlighting or twilight will stars be overwhelmed by the sky brightness given such short exposures. So it is possible to photograph stars even from built-up areas using this technique.

In fact, some of the most spectacular pictures can be taken during twilight, since foreground objects will be seen silhouetted against the sky, and the sky background will appear an attractive blue colour. Under these circumstances, even film as slow as 64 ASA can be used to record stars, as the sky brightness 'loads up' the emulsion grains with light, so that any additional light, such as from a star, stands a better chance of being recorded than when against a completely black sky. The technique of *preflashing*, giving a prior exposure to weak light, may be used by professional astronomers to bring out faint objects in a similar way. Moonlight can have the same effect. But the timing of twilight exposures is critical for best results: it is necessary to wait until the first stars are just visible against a dark blue sky. On slow film, with a wide angle lens, you can photograph the brightest stars most effectively.

Foregrounds are just as important in star photography as in everyday photography for interesting pictures. If the horizon is dark, you could try using a flashgun repeatedly to reveal nearby trees or buildings. It is worth looking for interesting buildings to show against a starry sky.

Sun, Moon and planets

With long focus lenses, you can photograph a number of solar system objects. The most difficult, oddly enough, is the

Sunrise *Unless the Sun is so dimmed by haze that you can look at it, never try to photograph it. 300 mm lens with 3 × converter, 1/125 at f/16, Ektachrome 400*

Solar eclipse *During total eclipse a brief exposure reveals the Sun's bright chromosphere. This 1/125 sec exposure was on Kodachrome 64 with a 400 mm lens*

Sun—which is even potentially dangerous unless you take precautions. In this case, there is just too much light and some means of cutting it down is needed.

One way is to wait until sunset on a misty day, so that it is possible to look at the Sun with the naked eye without discomfort. Then normal shutter speeds can be used. The camera's metering system, however, will give an average exposure for the whole view so the Sun's image itself is likely to be overexposed. If you are interested in recording any surface details, such as sunspots, you should give one and two stops of underexposure compared with the meter.

When the Sun is low in the sky it is reddish and its outline and surface features are distorted by the thickness of the Earth's atmosphere you are viewing through. But when it is higher in the sky very dense filters are needed to reduce its light and heat to a level within the range of camera and film. A neutral density of about 5 is needed. This can be provided by conventional ND filters, but usually only by combining several. The filter ring of a long telephoto is often as large as 72 mm, so such filters can be expensive. It can be dangerous to stare at the Sun even when using filters. While the filters may cut out the visible light, they may transmit infrared radiation which can damage your eyesight. So never rely on neutral density filters for safety. A much cheaper material is aluminized mylar film—thin plastic film with a shiny aluminium coating, intended for use as insulation material in the aerospace industry or for decorative purposes. The drawback with this is that it is usually only sold in 50 m rolls, but it is very cheap for a given area, so if you can find someone with a roll they will probably be able to give you a piece large enough to cover your lens. The thinner the film the better—anything thicker than 0.012 mm will distort the image.

Aluminized filters usually block infrared as well as visible light, so it is safe to study the image using these filters. But there is always the risk that a filter will slip off, particularly if it is a thin aluminium film, stuck on with tape, allowing the Sun's full light and heat through into your camera and eye. Permanent damage to the retina is likely if this happens.

The Moon is a much safer and easier object to photograph. A lens of 200 mm or longer will show some lunar detail, and it is worthwhile photographing the Moon through its phases, from crescent to full back to crescent again, if only for possible use in duplicate sandwiches.

When the Moon is full, it can be
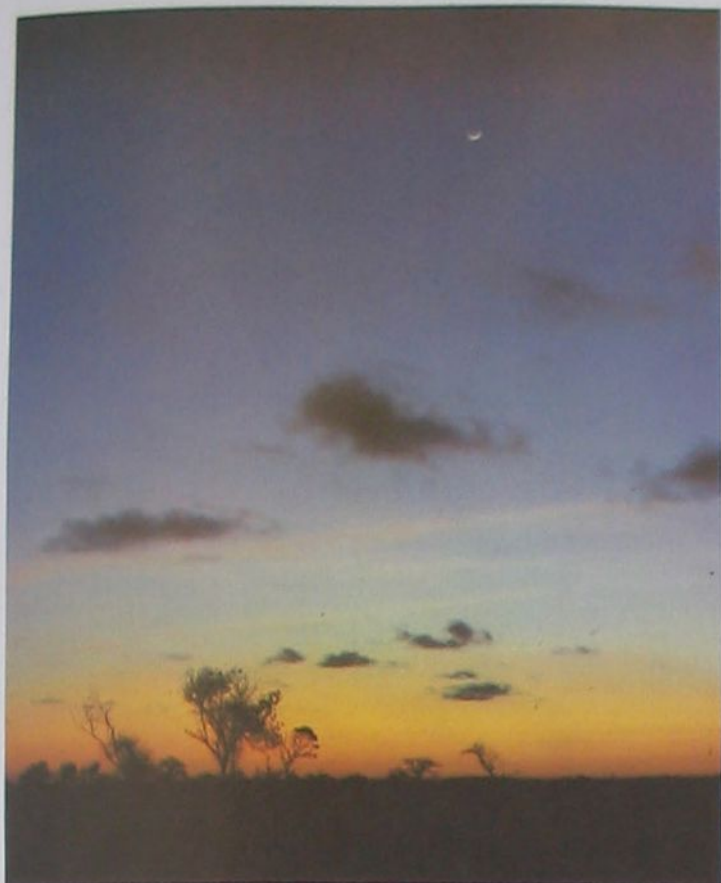
Michael Maunder
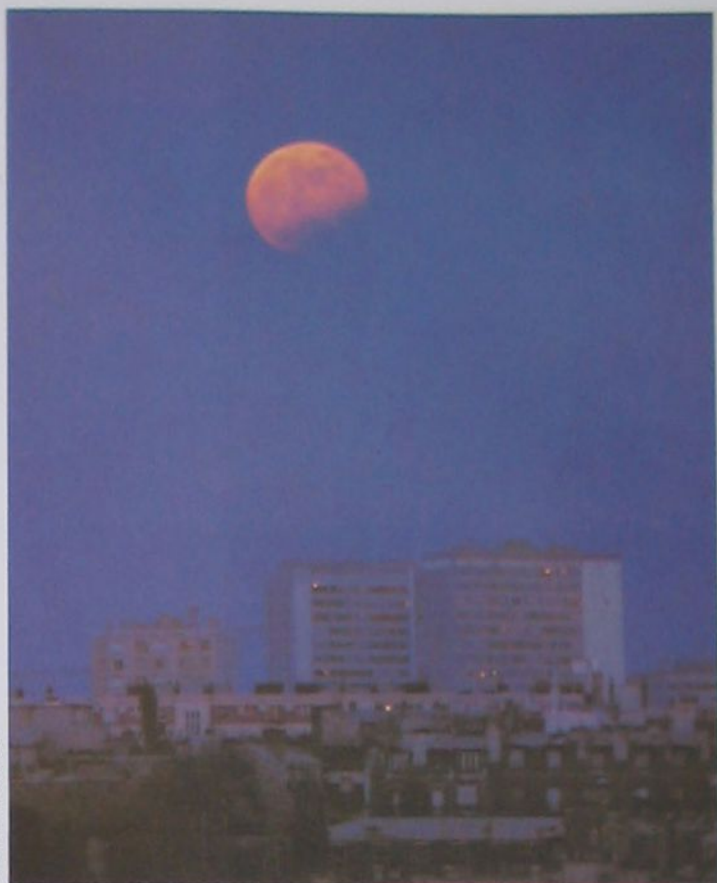
Sommer/Explorer

Twilight scene *The Moon, Venus and the star Antares appear on this 1 second exposure on Kodachrome 64 at f/5.6, taken from Tanzania*

Moon over Paris *The Moon was entering an eclipse as this picture was taken. Exposure meters give fairly accurate readings for twilight photographs*

Outer corona *The same eclipse as at far left (February 1980) but with a shutter speed of ½ sec. The inner corona is overexposed, but the outer corona well shown*

Science Photo Library

regarded as a sunlit landscape, and the normal exposure for the film should be adequate. This, however, is modified by the Moon's altitude above the horizon—when it is low, particularly in misty conditions, much more exposure is needed. Furthermore, the Moon's material is actually quite dark—about the reflectivity of volcanic lava—so bracketing the exposure is essential. When the Moon is a crescent, even more exposure is needed since its cratered surface is half filled with shadow and the reflectivity of the surface drops with increasing angle of illumination. Even so, photographs of a fairly thick crescent

Moon can be taken with an exposure time of about 1/30 second at f/5.6 on 64 ASA film. When the crescent is very thin, however, an exposure as long as 1 second may be needed.

Eclipses

Partial eclipses of the Sun can be photographed using neutral density filters, as in the case of photographing the Sun itself. But in the case of a total eclipse of the Sun—very rare from any particular location—no filters at all are needed. During the interval, lasting only a few minutes, when the Moon completely covers the Sun, virtually any

exposure will reveal a different aspect of the eclipse. Using slow film, 1/250 second at f/8 will show the bright inner corona and prominences, while a one second exposure will reveal the faint outer corona, with the inner corona overexposed. A focal length longer than 300 mm is needed for good results. Be ready for the 'diamond ring' effect at the beginning and end of the eclipse, when the first ray of sunlight may break through a valley on the Moon's edge, but bear in mind that the full brilliance of the Sun follows almost instantly after the end of the total phase. An exposure of 1/250 second at f/8 on 64 ASA film will record the diamond ring.

Partial phases of eclipses of the Moon can be photographed with the same exposure as the Moon itself. But when the total phase begins, the Moon can get very dark and even a long exposure on fast film at full aperture may not reveal it. A one second exposure at f/4 on 400 ASA film will, however, usually show the Moon's reddish disc during totality.

Printing for quality

With practice, most darkroom workers can regularly make satisfactory black and white prints. But to make every print to show quality, you must develop a rigorous technique and pay constant attention to detail

Producing a fine print is essentially no different from producing an ordinary good print. It is simply a matter of getting the very best performance possible out of each component in the printing process. It has even been said that stubborness is a vital ingredient of producing a fine print. Indeed, a refusal to give up, the determination to go back and try yet another sheet of paper is essential if you are to get the best from your negative.

In making a fine print you will be looking for subtle changes in tone and making use of minutest variations in the print qualities to arrive at the very best rendering of the negative of which you are capable. Because you are working with such precise modification to the print it is absolutely essential to eliminate any element of chance, anything that might cause unwanted variations in the results. A second or two too much exposure in the sky, a developer that is a degree or so too hot—minute errors like these can destroy the precise control needed to make a fine print.

Cleanliness

You can avoid errors by adopting a repeatable, organized routine for every procedure so that even the minor, but still important, details become virtually automatic. To make every process repeatable the first essential is cleanliness. The darkroom needs cleaning at least as often as any other room. Do not forget the tops of safelights and cupboards. Use a vacuum cleaner rather than a brush to remove dust. Paper towels make dust so it is better to avoid them. Keep plenty of clean cloth towels to dry your hands on and locate these at suitable points in your darkroom—near the sink, for example, so you do not let your hands drip as you approach dry work tops. Do not let any chemicals get on to the dry bench. Clean up any spilled processing solutions before they dry and become chemical dust. Always mix chemicals outside the darkroom so that no fine dust will contaminate it. Dishes and mixing vessels should all be labelled so that those used for developer are never used for anything else.

Each pair of tongs should be kept for its own solutions only. Although some cross contamination between stop bath and fixer may be tolerable, even a few drops in the developer will ruin it for quality work. When moving a print from the developer to the stop bath, pick it up

Washpan *Careful control of the original exposure is only half the story: a good image often requires just as much care—perhaps more—during printing*

by a corner to avoid kinking the paper, let it drain a few moments and then lower it into the stop bath—but let it drop at the end. In this way the tongs do not make contact with the stop bath and so there is no carry over back into the developer.

When you are organizing the darkroom try and make things easy for yourself. Arrange the dishes so that you do not have to move more than is necessary, and try and set things up so that you can see each print while you are working on

the next one. Organize a suitable flow of operation (see page 322).

Equipment check

Although it is possible to get good results from a poor enlarger—a good lens is essential, however—you will save yourself much time and disappointment if you get it into good order from the start. Check the steadiness and rigidity of the assembly (see page 308). Even the slightest movement during exposure will make sharp prints impossible.

If the enlarger is particularly prone to vibration you could try fitting a steady bar between the top of the column and the wall—but this is worthwhile only for a

Bob Cross

Overdevelopment *This shows the difference between an Ilfospeed print 'overdeveloped' for two minutes (upper left) compared to one developed 'normally' for one minute, both in Ilfospeed developer. The subtle tonal difference can be useful*

heavy enlarger. A loose floorboard or a wobbly bench can make the best enlarger useless. If possible, avoid moving about or touching the bench during exposure.

Now check the enlarger illumination and lens performance (see pages 1966 to 1969) and make sure that negative masking is efficient. The negative carrier should not permit even a glimmer of white light to pass through from the rebate of the negative. Any excess white light passing through the lens will degrade delicate highlight detail by causing flare in the lens.

Refined techniques

Although the starting point for a good quality print is careful choice of the type and make of printing paper (see pages 2236 to 2239), you can often get much more out of your paper by careful exposure and processing. There are no set conditions on how a print is made—every fine printer has his own personal procedure. But one of the ways fine printers manage to get such rich looking prints is by using a grade of paper that is slightly too hard for the negative. This gives an extra sparkle to the fine detail but has the unfortunate side effect of blocking up the shadows and the highlights. A little careful shading and burning-in then brings detail back to these parts to give a print with a feeling of depth and brilliance that could not have been made on the 'right' grade of paper.

The local exposure controls of the experts are basically no different from the usual dodging techniques. Plasticine, for instance, is very often used in place of card for dodging as it can be quickly shaped and pressed on to the end of a thin black wire. You can copy this idea—but use red or black plasticine to avoid reflecting unwanted light back on to the paper and, as with card dodgers, keep the wire moving as well as the dodger.

When there are several areas to be dodged in a print, it may not be possible to do them all during the course of a single exposure. A rather awkward landscape may require three or four exposure 'areas' for the best print image. A dark foreground may need restricting to, say, ten seconds, compared to the best 'average' exposure for most of the rest of the scene of perhaps 20 seconds. Further printing—burning-in—may be required for other areas such as the sky and other highlights, perhaps exposures of 30 and 40 seconds are needed in these areas. If it is impossible to make the print by giving a single exposure and gradually masking off each area as their exposure is reached, a succession of single exposures will have to be used.

There are a number of different ways in which you can carry out the exposure itself (see illustration). Quite how you go about this depends as much on the nature of the image as on your preferred exposing routine. But with any complicated print, planning is essential. And it is often very helpful to sketch the images to establish the most efficient routine in each case. But bear in mind whether or not you are using proper masks, such as on a printing jig (see page 362) because some sequences may be impossible if you are shading by hand.

You can also adopt roundabout

Dave King

Contrast control *Prints for reproduction should, ideally, be slightly on the soft side. Printers sometimes use guides like this to control tones in reproduction*

methods of shading by using overlapping masks. Suppose, for example, the top and bottom of a print require more exposure than the middle. Give the whole print the 'main' exposure corresponding to this middle region—say, 20 seconds. Then shade off the entire middle and lower part of the image and expose for the extra period required for the very top—say, another 20 seconds, making a total there of 40 seconds. Finally mask off the top and middle of the print and give the extra exposure required for the bottom—say, five seconds to make the total here 25 seconds. This method is particularly suited to the use of a print mask jig. Filtration changes—such as used for multigrade or colour printing—can be applied in the process.

Whatever method of timing you use you will find a foot switch very useful, unless your enlarger timer has a sufficient switching delay to enable you to get to your station once it has been tripped. It leaves your hands free at the start and finish of the exposure and makes dodging much easier.

Using a timer

Fine printing depends on subtle nuances of tone, and so precise and repeatable exposure control is essential—particularly if you are producing a run of similar prints. If you time your exposures by watching a clock, no matter how careful you are, errors of up to half a second are liable to occur at the start and finish of the exposure. This is not good enough for first class work.

The best solution is an enlarger timer with it complete—and repeatable—accuracy. A cheap and reliable alternative is a metronome. Although the switching operations are left to you, these allow you to time for shading and burning-in without taking your eyes off the base-board. Most users set them to the 60 mark to give one beat a second but some prefer the increased accuracy of 100 beats to a minute. When using a metronome you must start the count with zero as you begin the exposure.

Print flashing

Annoyingly bright highlights and distracting detail such as bright reflections against a dark background can be removed or darkened by 'torching' or localized *print flashing*. For this you need a small penlight torch with a black paper cone—or snoot—fitted over the end to give a small, dim pool of light. With the red swing filter in position beneath the enlarger lens you can then go over the print image painting out objectionable highlights or other details.

The technique does require some care—the flashed image is, after all, only a grainless fog—and it is worthwhile making your own tests to establish maximum and minimum flashing durations, the ideal working distances, and the best size of snoot for your particular penlight torch.

Area flashing—exposing the whole

2447

Chris Lyon

Dodging sequences

The diagram shows a problem landscape where a print requires, say, 40 seconds exposure to darken the top (A) compared to just 15 seconds to hold detail in the foreground (D). The main part of the scene (B) needs only 20 seconds but an extra 10 are needed for the middle-distance (C). There are numerous ways in which print this. One sequence would be to give 15 seconds, mask D, give another 25 seconds but shade B after 5 and C after a further 10 as you shade towards the top. Or time 40 seconds and shade D, B and C in turn.

A — B — C — D

print very briefly to white light before or after the actual printing exposure—can be a useful way to reduce the harshness of large areas of highlight detail without too greatly affecting mid tone and shadow details.

The flashing exposure is kept very small relative to the amount of white light needed to produce the dark areas of the print and so has no significant effect there. In the highlights, however, the paper receives little light through the dense parts of the negative and the flashing exposure is proportionally large and has a flattening effect. The flash exposure alone should not be enough to produce any greying of the paper or the print will simply look fogged. It is easy enough to make test prints to determine the threshold at which this occurs. But keep to the same enlarger height, aperture and print flashing times for any particular type (and speed) or paper.

One easy method is to leave the negative in the enlarger at the printing height, at the same aperture, and to give your flash exposure through a piece of opal glass and a suitable neutral density—such as 0.6 filter. You will have to experiment to find the best time, but try a quarter of the normal exposure as a starting point.

Development factors

The type of developer and its concentration has a significant effect on image colour and quality. This is an area where your own experiments and choices are the only guidelines. Most manufacturers make a range of developers to give warm, neutral or cold tones with their papers—but you may find that you prefer one manufacturer's paper with another's developer.

Although a dish of developer may produce prints all day you will find that it only gives its best for an hour or two. Be generous with chemicals. Make small batches of developer and change them frequently.

Accurate and repeatable development times are essential for consistently high quality results. The development times recommended by the makers are often for the shortest processing times. Richer prints with better gradation can often be obtained by extending development by up to double this time.

With some papers and developer, quite a degree of contrast and tone manipulation may be possible by careful adjustment of both exposure and development times. There may, for example, be quite a difference between a print exposed for 20 seconds and

The right time? *Although manufacturers quote a 'right' time for developing a print in a particular developer (centre) you may prefer to adjust exposure and development time between an image which is underexposed but overdeveloped (left) and one which is overexposed but underdeveloped (right)*
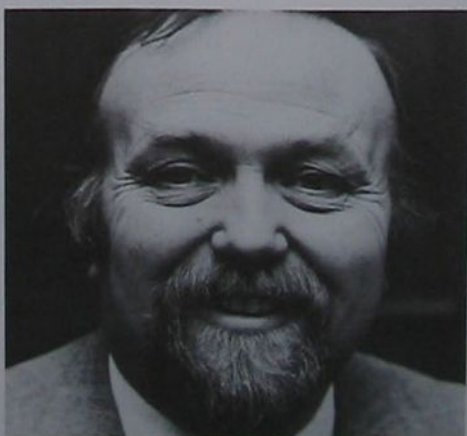
developed for 1¼ minutes and one exposed for 15 seconds and developed for 2½ minutes. With RC paper you find the extra depth of tone obtained by increasing development time from one to two minutes—without changing exposure—far outweighs any inconvenience of the longer processing time.

But fiddling around with exposure and development times can lead to slapdash techniques unless proper tests are carried out. Through tests you actually see the effect of, for example, giving too much exposure and too little development. In the process of making exposure and development tests, make sure you establish the actual minimum and maximum development times in order to get clear highlights and pure blacks.

Other developing techniques that you can use to improve the quality of your prints are two bath developing and water bath developing. In two bath developing the print is first partly developed in one developer, say a soft working formula that brings out the delicate highlights and subtle mid tones and then briefly in a more energetic solution that builds up strong blacks.

Water bath development is slower but more controllable. The print is placed in developer until the image begins to appear and is then gently lowered into a water bath. It is left there for about a minute without agitation, in this time the developer soaked into the paper continues to work. In the shadows it is soon exhausted and so development in these areas is curtailed. There is little developer used in the light parts of the image and so these continue to develop. This process is repeated two or three times until the desired result is obtained. To avoid staining the print both the water and the developer must be fresh.

Always end development by quickly transferring the print to a dish of active stop bath—it is best to use the type which includes an indicator chemical to show when the solution is exhausted.

The most suitable fixer for fine printing is normally plain hypo. High speed fixers are efficient but are more difficult to wash out of the paper and more likely to lead to fading in the long term. Two bath fixing (page 1922) should always be used for your best prints and fixing times should be kept as short as possible.

Bob Cross
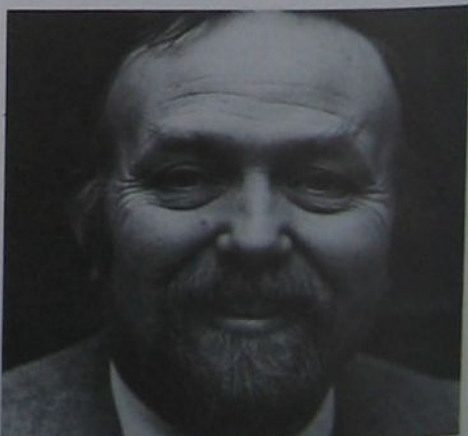
What went wrong?
ARCHES

Archways are useful in pictures—they help contain and frame a scene. But there is more to it than that, as John Sims points out in his criticism
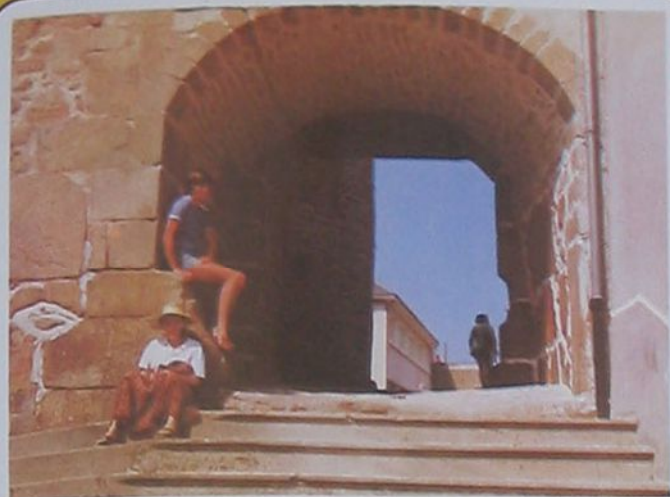
This is an example of what I call a neither/nor photograph. It is neither a portrait of the two people sitting on the steps to the left of the alleyway nor is it at all descriptive of where the shot was taken. Even the character at the end of the alleyway is more significantly compositionally than the apparent subjects. If, in fact, the portrait had been the main intention, with some indication as to the location, I would have got much nearer to the subjects, though still keeping them to the left of centre. To their right I would have used the tunnel to frame the buildings beyond, ensuring that I didn't have a silhouetted passer-by as a competing distraction. To achieve both of these aims I would have chosen a 24 or 28 mm lens and, if possible, a slightly higher viewpoint
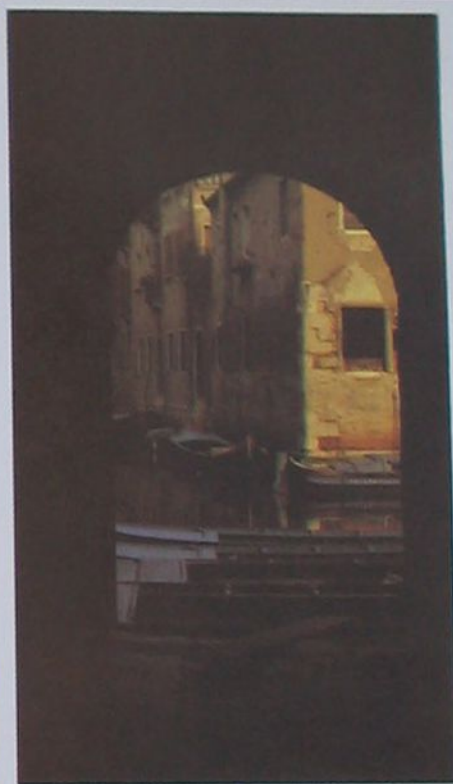
This photo attempts to use a frame within a frame to produce a more satisfactory photograph. Its main attraction lies in its simplicity of composition, particularly as the light falling on to the smaller part of the building balances the remainder in shadow quite well. Balance is also helped by the relationship between the vertical red and yellow stern of the boat in the centre of the picture and the strong blue horizontals of the foreground boats. Having said that, however, it is not a great picture nor is it a particularly memorable one, mainly because it has no clear or interesting statement to make

Church interiors are notoriously difficult to photograph even under favourable conditions due to the wide range of illumination levels normally present. Our example here, of St Mark's Basilica in Venice, only hints at its splendours. The photographer has tried to cram as many facets of the building as possible into one image. The windows have all detail burnt out and the cupola is only two-thirds visible. I would rather try to build up a feeling for the whole by concentrating more on small areas with interesting detail, which would both minimize exposure problems and reveal more about the nature of the building

Of the two attempts to use the frame within a frame device shown here this one works least well. The three arches which break up the horizontal impose a basic symmetry on the picture which should be echoed in some way by the view through them. The sky is dull, lacking any intensity or colour. I would exclude it by making the water area more significant, using a higher and closer point of view and adjusting the amount of foreground accordingly. Only the view through the left arch has been given any consideration. By photographing this arch alone, emphasizing the clear relationship between the arch–frame and the three levels of arches opposite, a much more satisfying picture would have resulted

DILSTON HALL
2011

Creative approach
IMPACT

It must be every photographer's aim to take a truly memorable photograph—a picture that makes people sit up and take notice. But just what are the qualities that give a picture impact?

Photos abound and surround us in our everyday lives, yet only very few of them actually succeed in grabbing our immediate attention. These are the rare photographs that stop you in your tracks and provoke an immediate response—whether at an exhibition, on an advertisement hoarding or on the printed page. What is it that makes these photographs stand out from the others—what is it that gives them impact?

While this question is difficult to answer directly, there are certain features that can be identified in a powerful image. Simplicity is one key quality—what is going on in the picture must be immediately apparent if a photograph is to grab attention in this way. Colour, graphics, viewpoint, perspective and all the other pictorial elements that are dealt with in Creative Approach articles are all of great impor-

Jumbo *A combination photograph made for Britain's Noise Abatement Society*

tance in giving a photograph impact. These are certainly qualities worth striving for but success with any one of these elements, or even all of them combined, does not necessarily guarantee that a picture will have impact.

Impact is all of these things, yet it is equally a product of the subject itself, for instance, an action or a fleeting expression. The photographer is therefore never entirely in control and must be prepared to accept that the least controllable influence on a photograph—luck—plays an enormous role in giving a photograph impact. Even a shot having no colour and far from perfect composition can still have enormous impact—probably because of where the photographer happened to be standing and

This dramatic combination photograph was used by Britain's Noise Abatement society to aid recruitment and draw attention to the plight of people living close to airports.

The impact results from the careful combination of the two images in the final photograph. To have reduced further the gap between the house and the plane would have made the technique used obvious and robbed the overall image of plausibility. Increasing it, however, would have lessened the effect.

In a sense the photo is a lie—planes do not, as a rule, fly this close to houses. And yet this degree of distortion is necessary to get the photo's message across in the most direct and effective way.

Creative approach

what was going on at the time.

Newspaper or magazine photographs often have tremendous impact upon the reader, but this is usually because the image is accompanied by a caption or headline that places it in its context. However, when seen out of context by someone unfamiliar with the subject depicted, the image no longer has the same significance. True visual impact is not dependent upon additional infor-mation. Nor indeed, does such a photograph have to have anything to do with events or action of any sort. Portraits, abstracts, still life, in fact any subject can yield images with impact purely through the photographer's vision and a combination of techniques, lighting or luck.

The photographs shown here all have impact for one reason or another. It may be because the photographer has caught a moment that could never have been seen by the naked eye. It could equally well be because the photographer constantly exposes him or herself to unusual situations—wars, public events or sports —where striking extremes often occur.

But the importance of imagination should never be underestimated and frequently it is the purely creative approach which repeatedly and instinctively helps a photographer produce images with impact—a process that

Lines of colour *The seating area at Toluca football stadium, Mexico*

Imagine this picture without the figure. It would be fairly effective, with the interesting combination of horizontals, broad, curving bands of bright colour and two weak slanting lines. But with the figure it gains scale and human interest, and has considerable visual impact. Had the figure been located more centrally the effect would have been reduced; but being off-centre, quite close to the 'golden mean' of composition. Although the figure is small, the human form immediately attracts the eye, providing the shot with an evocative focal point

Rod Williams/Bruce Coleman Ltd.
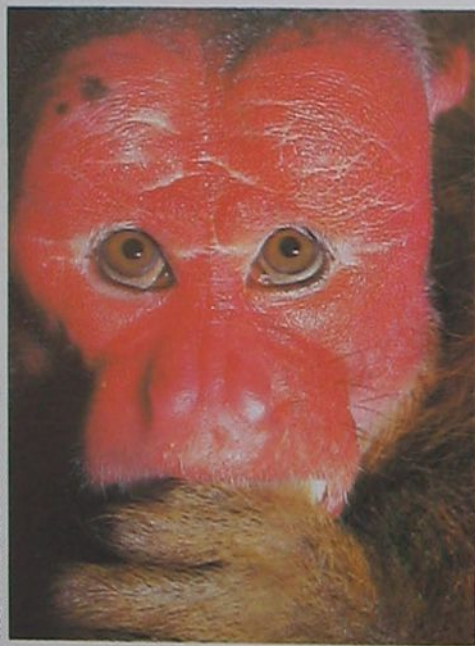
Monkey thoughts *A Red Uakari monkey, an inhabitant of the Amazon basin*

The monkey gazes straight into the camera in an almost human pose. Its eyes stare straight into ours, and much of the impact of this shot comes from seeing a monkey's face in close-up. The raised paw balances the composition and reinforces the animal's look of terror. But undoubtedly the image would be weaker in b & w— without the startling texture and colour of the face, the contrasting eyes would not be quite so rivetting

involves all of the creative choices and which can never really be satisfactorily pinned down. All that can be done is to hint at what makes certain photographs great. If there was a formula that could be used to create impact, everyone would be able to produce 35 such images on every roll of film. But no such recipe for success could ever exist—it would be exploited so extensively that all the impact would rapidly be lost.

Blitz *St. Pauls towers over burning London, 30th December 1940*

Blowing in the wind *Taken on a Brazilian beach with a telephoto lens*

This photograph of St Paul's cathedral in London was taken during the worst period of German bombing in World War 2 by *Daily Mail* photographer Herbert Mason. To get his shot, Mason had to display considerable courage, standing on a city roof during a heavy raid, focusing and refocusing as different sections of London became visible through the gloom. 'Then a wind sprang up. Suddenly the cross, dome and towers (of St Paul's) stood out like a symbol in the inferno.'

This shot is memorable not primarily because of its visual strength, though it is well composed, but because of what it stands for. The image was tremendously stirring for people in a war torn country and, indeed, still has some power even today. The point to remember about images like this is that the photographer's treatment of the subject is virtually irrelevant—providing the picture is clear, the subject speaks for itself. The photographer's skill—or luck—lies in realizing the potential of the subject.

Two elements are undoubtedly crucial to the success of this shot: the simplicity of the image, with the background plain and the figures almost in silhouette; and the dynamic pose of the two women—which the simplicity shows up well.

Perhaps the photographer was initially attracted by the fascination of the women carrying heavy loads on their heads and by the pleasant lighting. These features alone would have made a good shot. But, either through luck or skilful timing, the photographer has caught them at a perfect moment—as their legs bend in mid stride, as their arms come out to balance and, most importantly, as the wind catches their skirts—to make the shot a winner.

The outflowing skirts help to visually balance the women's loads, emphasize the similarity between their figures and provide strong, flowing diagonals to complement the uprights and horizontals—giving the shot a tremendous sense of fluid movement

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In abstract, the photographer's role in creating the picture is far more significant. Here, the choice of viewpoint was crucial. The low view contrasts an ordinary fence against a deep blue sky—underexposed and polarized for maximum saturation—to create a striking colour contrast. The simplicity of the image and the strong sunlight make the most of this contrast. But the real key to the success of the image is the photographer's decision to shoot upwards at an angle. This has transformed static uprights and horizontals into a dynamic crosswork of diagonals and allowed the perspective of the uprights to converge strongly.

Green fence *An unusual viewpoint with strong composition and colour*
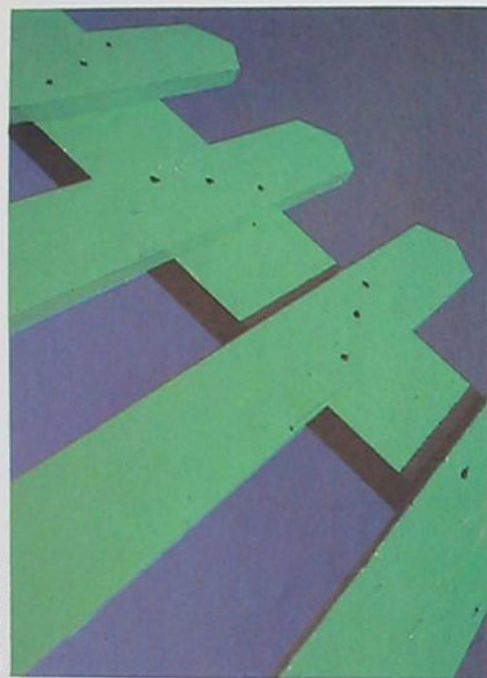
Ian McKinnell

Until you know the background to this picture, taken in Sulawesi, it appears horrifying. The well-dressed child seems quite unconcerned by the carnage that surrounds him.

In fact, the Toradja sacrifices, which take place at the funerals of important people, are part of their tradition. Children frequently play an important part in these rituals, and the sacrifices do not have the same emotional content to them as they do to us.

For us, the impact of the photograph comes mainly from the contrast between the gory dead beasts and the child playing unconcerned among their carcases.

In this case the caption material if anything reduces the impact that the picture has on Western eyes

Buffalo boy *The aftermath of a ritual sacrifice by the Toradja people*

Vautier/de Nanxe

These three pictures of the American flag being raised over Iwo Jima show how luck can often play an important role in giving a photograph impact.

The photograph on this page has become the most widely reproduced photograph of all time. It was taken, almost by accident, by Joe Rosenthal of Associated Press. Having prepared himself for a shot of the flag raising he was distracted by Sergeant Bill Geneaust with his movie camera (larger picture, opposite page). Turning suddenly, he just caught the Marines as they were raising the flag. Not sure if it was a good shot he took two more photographs, one of which is shown in the inset on the opposite page.

It is quite clear why the first shot has been so successful. The flag had not yet been fully raised and was still in a state of movement. This movement is caught in the strong diagonal of the flagpole combined with the acute angle of the upreaching hands with the flagpole. The other two shots lack this strong sense of movement and appear static in comparison.

Notice also the sense of drama created by the space left for the subject (the flagpole) to move into. It is difficult not to look at the empty space where the flag will be when fully raised. This is partly due to the diagonal and also to the way in which the flag has been caught by the breeze. Once again this shot needs a caption to give it full impact, but even without any additional information it is a powerful photograph in its own right. However, it was the way it seemed to crystallize an American victory that gave it its initial success

Raising the flag *A classic series of shots, taken on Mount Suribachi, Iwo Jima in 1945*

Landscapes are one subject where it is virtually impossible to 'inject impact' into the photograph. Instead the aim must be to capture as much as possible of a scene's immediate grandeur. For this it is necessary to work out just why the scene has impact and to maximize the dramatic effect by concentrating on some features and suppressing others.

In this photograph the drama is essentially already present in the energy of the sky. To give prominence to this element the photographer has shot slightly upwards, using the dark foreground and mountains on either side to frame the sky with a strong curve. Slight but deliberate underexposure has helped in suppressing distracting details and in giving a richer sky.
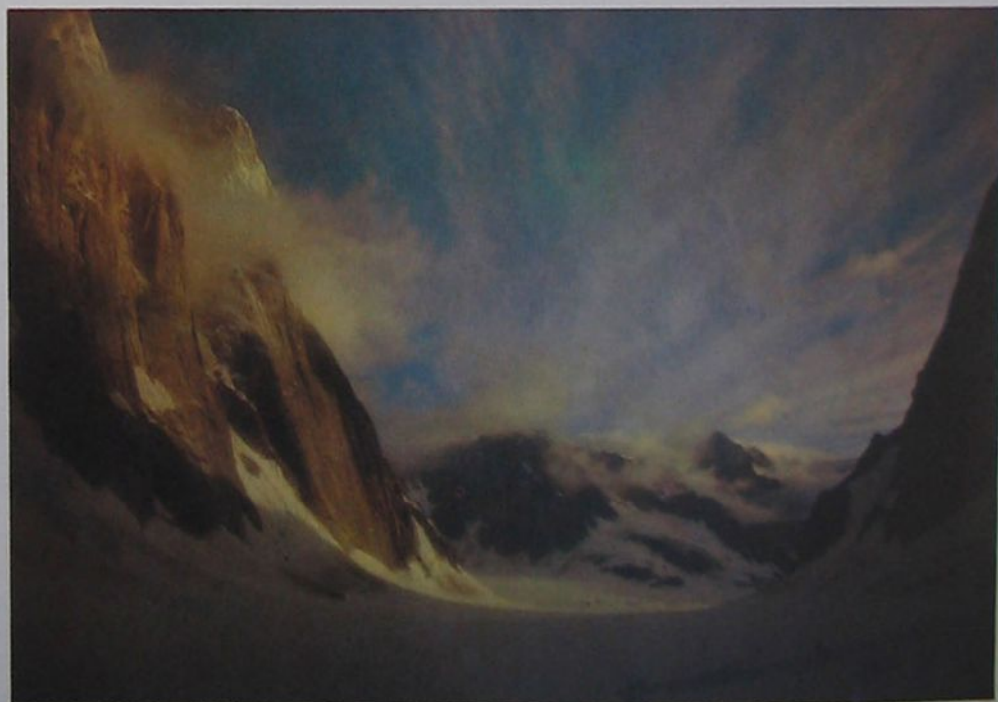
Moose's Jaw, Alaska *A carefully angled shot of a dramatic landscape*

Stereo images-1

Normal photos lack one vital feature of our view of the real world—the impression of depth. By presenting a separate image to each eye, stereo photography can restore this deficiency. But does it?

The human brain is remarkably adaptable and readily accepts a photograph as a good representation of reality. Yet a normal photograph lacks one vital quality of our view of the real world—the third dimension. Holograms may one day provide true 3-D images, but in the meantime, if we want an impression of depth and solidity, we must be content with the optical illusion of *stereoscopic* pictures.

The word 'stereoscopic' comes from the Greek words *stereos*, meaning 'solid', and *scopeo*, meaning 'I view'. Although it had been used occasionally before in the science of optics, the word was first applied to 3-D pictures by the eminent British scientist, Sir Charles Wheatstone, in the 1830s. And it is Wheatstone who is generally credited with the original idea of stereo pairs.

Wheatstone realized that an illusion of solidity could be created by looking at two drawings made from slightly different viewpoints, one with each eye. With the aid of a *stereoscope*, the brain can be tricked into thinking that the pair is a single 3-D drawing. Few artists had the skill to draw stereo pairs effectively, but Wheatstone's friend, Henry Fox Talbot (see page 215), suggested the idea of using pairs of calotypes. Not being a photographer, Wheatstone could not make the calotypes himself. But under his

Victorian viewer *based on the Brewster principle; using refracting eyepieces*

instruction, Henry Collen made a stereo portrait of the inventor of the computer, Charles Babbage, in August 1841 and stereo photography was born.

Seeing in 3-D

The basic idea behind stereo photography is to take two pictures from viewpoints corresponding to the position of each eye. Each eye is then presented with the appropriate picture to fool it into thinking that it is looking directly at the subject. Although this is simple in theory, the presentation of stereo pairs is much harder in practice.

The main difficulty is per-

suading the eye–brain combination to see the stereo pair as a single image. When you look at a real object, both eyes turn in towards it so that the lines of sight from both eyes *converge* on the object. In this way, two slightly different images of the object are superimposed in the brain. Because for each eye, the other eye sees 'behind' the object, we get the impression of depth. It is achieving this superimposition that is the big problem in viewing stereo pairs.

It is possible to view stereo pairs unaided providing they are printed correctly but it is very difficult. It is difficult

because the eyes naturally converge more to look at nearby objects and so both eyes tend to look at either one or other of the stereo pair. Unaided viewing usually involves trying to relax the eyes as if they were really looking at a distant object—that is, deliberately deconverge them. You then see four images, both of the pair with each eye. With concentration, the eyes can be focused together on the central two images while keeping the distant convergence, to fuse them into a single stereo image. But this combination of a low convergence for a distant object and a close focusing distance is unnatural, and causes eyestrain even if you can achieve it—few people can.

Seeing in depth

Separation for close-ups

For shots at this distance, much less separation is needed to give a good stereo effect and a base distance—the distance between the centres of the pictures—of about 20 mm is quite adequate
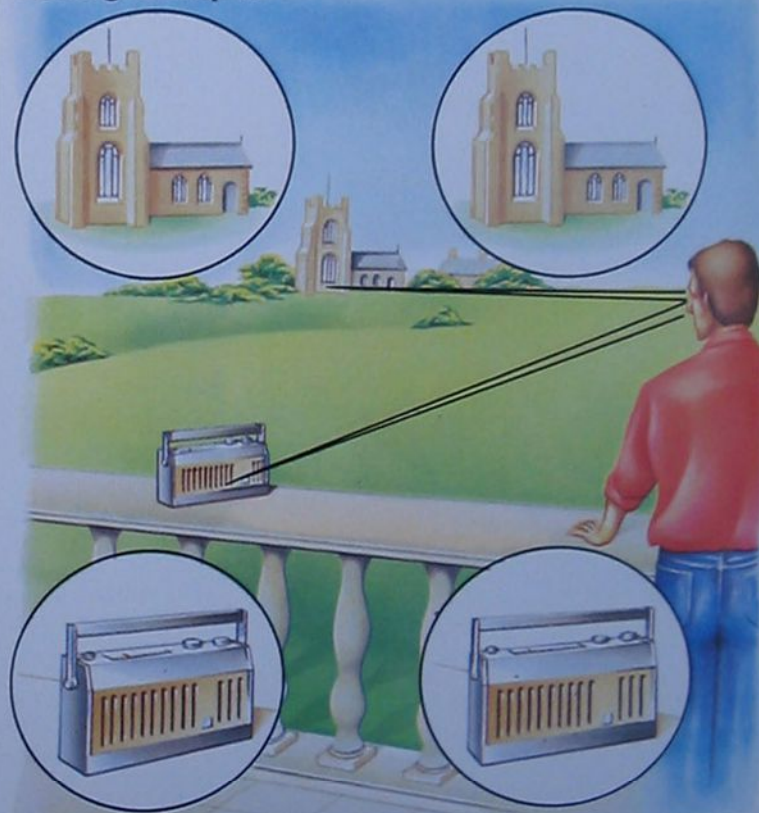
Binocular division *With distant objects, the image seen by each eye is little different and the impression of depth is limited. With close-up objects, depth perception is more marked*

2454

If one of the pair is reversed and viewed with a mirror held vertical in between (see page 1472), convergence can be more natural. However, even this is not easy to achieve—partly because the eye has too wide a field of view and sees more than just the stereo pictures. So a viewer is normally essential.

Stereo viewers

In Wheatstone's stereoscope, there were two mirrors, each set at 45° in front of each eye. The pictures could then be held at either side of the viewer so that the image from each one was reflected to the appropriate eye. This means that each eye sees only the image it is supposed to and a stereo effect is easy to achieve.

Unfortunately, the Wheatstone viewer still gives an unnatural combination of convergence and focusing, so prolonged viewing may cause eyestrain. Also, because mirrors reverse the image, the negatives had to be made in reverse. So the Wheatstone viewer never achieved widespread popu-

The interpupillary distance of the eyes is not great enough to see relief this far away but an unnatural

stereo effect can be achieved using a base distance of 80 mm or more

larity. Nevertheless, Wheatstone type stereoscopes are still used for viewing Stereo X-rays because they can be used with any type of picture.

But it was Sir David Brewster's refracting stereoscope of 1849, based on Wheatstone's idea, that opened the way to the popularization of stereo photography during the 19th century. Instead of mirrors, Brewster used a pair of prisms side by side. The two pictures were placed some distance apart beyond the prisms, but the prisms bent the light from them towards the eyes so that it appeared that they were both in the

same place. The eyes can therefore converge and focus fairly naturally while still superimposing the images to give the stereo image.

Most subsequent viewers for the amateur are based on the same principle. However, instead of using prisms, they may use a combination of lenses and mirrors. The lens allows the pictures—usually slides—to be brought close to the eyes so that the image almost fills the field of view. Most of the cheap stereo viewers of the 50s and earlier used cheap, sometimes plastic lenses, and quality is generally inferior to earlier viewers.

Base distance

During the 19th century, when stereo photography was at the height of its popularity, there was considerable confusion about how far apart the setero images should be—that is, the *base distance*. Distances varied immensely. A congress was held in 1859 to decide a standard and this was set at 70 mm.

Logically, the pictures should be the same distance apart as the eyes. This distance, known as the *interpupillary* distance, varies from person to person but is on average about 65 mm. For viewing stereo pairs unaided, then, theoretically the centres of the two pictures should be 65 mm apart. This limits the size of the pictures that can be used.

Refracting viewers, however, allow the images to be placed slightly further apart because they bend the light inwards—though the effective base distance is not altered. So with a refracting viewer, larger pictures can be used. But the maximum size is still limited and most stereo viewers of the last 40 years are designed for 35 mm.

It is often forgotten that the stereo effect varies with distance. With objects closer than a few metres, little separation is needed for a stereo effect and the normal base distance is excessive—indeed, a base as short as 12 mm can be suitable. For a distant view, on the other hand, a much longer base distance is needed to give a 3-D effect—though, of course, because we cannot normally see relief at great distances, a 3-D effect for a distant object might look unnatural. Typically, a base distance 1/500 of the distance of the subject produces an acceptable stereo effect for most people.

Stereo viewers

left image   right image

imagined line of sight
— real line of sight
— front of mirror

mirror — line of sight

left image   right image

— mirrors —

left image   right image

— prism
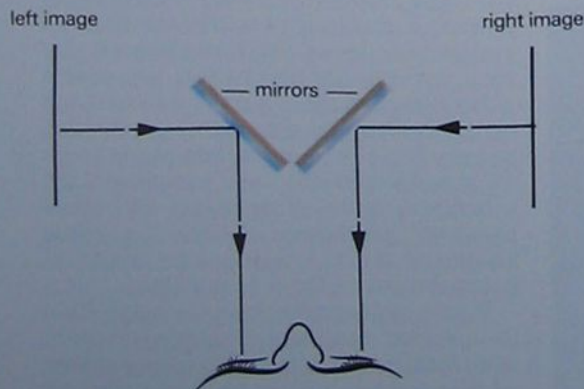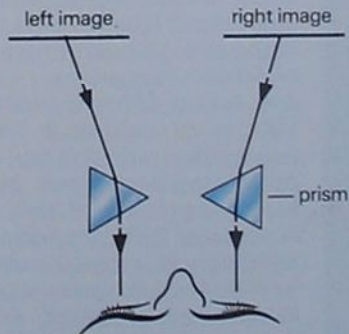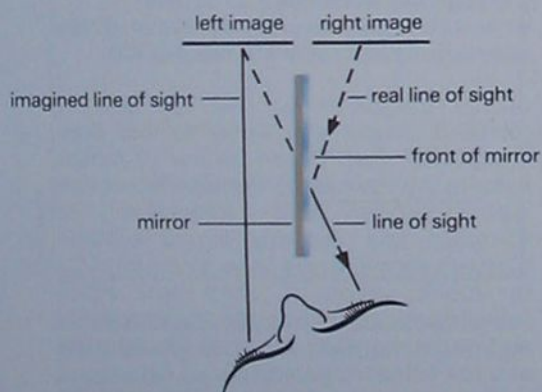
Mirror image (*above left*) The right eye is shown a mirror image of the righthand picture, printed in reverse. Because convergence is natural, the brain 'sees' just a single object, giving a stereo effect

Brewster's system (*above*) for viewing stereo pairs presented the correct image to each eye through refracting elements that bent the light towards the appropriate eye. Most hand viewers use this system

The Wheatstone viewer (*left*), showed each eye a mirror image of the right picture. The poor convergence–focusing combination may cause eyestrain, but the viewer takes very large images

Shooting the stars-2

**Taking photographs of the night sky through telescopes requires skill and care
rather than expensive equipment. Even with amateur means you can take
successful pictures of mountains on the Moon or distant galaxies**

Photographing the Sun, Moon and stars using an ordinary camera is quite easy to do (see pages 2442 to 2445). People who have succeeded with these techniques of *astrophotography* often want to achieve greater things, by photographing such things as nebulae, star clusters and planets. The techniques used for this are in many ways similar to those used by professional astronomers (see pages 1337 to 1340), but fortunately you can achieve quite striking results with comparatively cheap—often home made—equipment, based around an ordinary SLR camera and a good telescope.

Telescopes

There is little difference between a telescope and a long focus telephoto lens. A telescope has either a lens or a mirror to focus the light, just as the lens of a camera does. The focused image is viewed using an eyepiece, the magnification depending on the focal length of the eyepiece. As with photographic lenses, the longer the focal length of the main lens the larger the image, and the larger the lens the brighter the image.

Telescopes with lenses—*refractors*—are more common in small sizes. A typical refractor has a lens with an aperture (that is, diameter) of 75 mm and a focal length of about 1000 mm, giving an f-number of about 13.

The larger telescopes generally use mirrors to focus the light, as it is easier to make a large mirror than a large lens. A *reflector*, therefore, might have an aperture of 150 mm and a focal length of 1200 mm, making it f/8. *Catadioptric* telescopes, combining mirrors and a correcting lens (see page 1858) may have apertures of 200 mm and focal lengths of 2000 mm, giving f/10, though smaller and larger are also common.

Whatever the telescope, it is usually a simple matter to attach a camera in place

Camera view *A less magnified view of the Pleiades, using a normal 200 mm f/3 lens. Five minutes on Kodachrome 64*

Through the telescope *A 15 minute exposure of the Pleiades star cluster. 40 cm aperture, Ektachrome 200 rated at 400*

of the eyepiece, so that the lens or mirror's image will focus on the film. Adapters, often based on the T2 mount system, are available through telescope manufacturers and importers for virtually any camera mount system. Camera shops rarely have such adapters in stock, even if they sell small telescopes, so it is better to approach a specialist supplier for both the adapter and the telescope itself.

There is sometimes a problem with the cheaper, less versatile telescopes in that it is impossible to move the camera close enough to the lens or mirror to bring the image into focus. This is because the focus point—usually called the *prime focus*—is brought to a point where it can be focused on by a range of eyepieces. But the film plane of the camera is some 45 mm behind the lens mount, so the telescope must allow about 50 mm of focusing movement inside the focus point for most eyepieces in order to bring the prime focus to the film.

If your telescope does not allow this, then either you must modify it yourself, which calls for some engineering ability and knowledge of telescopes, or you must use *eyepiece projection*.

A. H. Davis

Eyepiece projection

This is useful both for allowing some telescopes to focus on the film plane and for increasing the effective focal length, and hence image scale, of a telescope. It involves using an eyepiece as a form of teleconverter or multiplier. The telescope-to-camera adapter must be designed to carry an eyepiece, and extension rings are used to move the camera body far enough away from the eyepiece that the image can be focused. This usually allows a camera to focus even if it cannot reach the prime focus, though it sometimes means using a very large image scale, with large, dim images very prone to vibration.

With this method, a telescope which is normally f/8, say, with a focal length of 1200 mm, may be turned into one working at f/80, with a focal length of 12,000 mm by using a 4 mm focal length eyepiece to project a magnified image on to the film. This scale is actually much too large for most purposes, and can only be used on the Moon and planets when conditions are good. For nebulae and star clusters prime focus photography is ideal.

R. Garner

N. W. Scott

Lunar mountains
A 30 cm aperture telescope was used for this view, with an exposure time of one second on 2415 recording film

Half Moon *The Moon's surface always appears more interesting when side lit than when it is nearly full*

Sunspots *Pictures like this require aluminized filters, as the Sun's heat can damage your eyes and camera*

Chris Lyon

Finding focus *The camera can either be at the prime focus (upper diagram) or you can project the image (lower)*

One common difficulty in astrophotography is that of focusing the camera. Many focusing aids black out at large f-numbers, and even with a large telescope the image can be dim and hard to see. Some manufacturers offer less heavily matt focusing screens, or even completely clear ones, in which case focusing by parallax (see page 1348) is needed. This is a difficult technique to use, and often a more successful focusing aid, which can be used with any focusing screen, is a viewfinder magnifier (see page 725).

The biggest problem by far in astrophotography is keeping the telescope pointing at the object being photographed, since for faint objects

exposure times of many minutes are needed. Even with the Moon and planets, which are bright enough to allow short exposure times, vibration of the telescope can easily spoil an exposure as short as 1/125 second.

Small telescopes on wooden tripods suffer most from this, and it is often best to remove the telescope from the mounting and fix it to a sturdy plank of wood (using, for example, rubber bands and v-shaped blocks of wood). This also overcomes the problems of balance when a camera is mounted on the end of a small telescope, but it restricts photography to exposures much shorter than a second. For any longer exposures, the Earth's rotation will cause the object being photographed to trail across the film. As a practical guide, for insignificant image trailing you should give no exposure longer than 250 divided by the focal length in millimetres, the result being in seconds. So for a 1200 mm focal length, exposure times should be shorter than 1/5 second.

For most photography through the telescope, therefore, the telescope must be driven so as to counteract the Earth's rotation. Although people are tempted to use the simple *altazimuth mounting* found on all the cheaper telescopes, the only really practical method is *equatorial mounting* in which one of the axes is fixed parallel to the Earth's axis. This means that, to follow an object through the sky, you only need to make one movement rather than two as with altazimuth mounting. A further drawback of the altazimuth mounting is that even if you track an object perfectly, its orientation changes as the Earth rotates, unless you happen to be at the Earth's

N. W. Scott

A. H. Davis

R. Garner

Prime focus (top) A 35 mm camera is attached to the prime focus of this home made 10 cm aperture telescope

Piggyback Mounting your camera on top of the telescope allows you to use less precise guiding on the stars

Observatory A 25 cm reflector, complete with equatorial mount, guide telescope and drive correction system

equator or poles. So while a star, say, in the centre of the field may remain a point of light, all others will trail round it. This becomes obvious with any exposure longer than a few minutes.

Equatorial mountings are made in a variety of types and sizes by astronomical telescope manufacturers, and enterprising amateurs can make them, often using scrap materials such as car axles. The main requirement is that the two axes be freely running and exactly at right angles to each other. One axis is fixed pointing at the celestial pole (see page 2442). Extreme sturdiness and freedom from vibration are essential, and for astrophotography the polar alignment must be as close as possible.

Some way of driving the polar axis smoothly, to counter the Earth's rotation, is needed—the usual system is a worm and wheel of high ratio, so that one turn of the worm produces an almost imperceptible movement of the polar axis. When using a focal length much greater than 1000 mm it is surprising how fast objects appear to move through the sky, yet how fine a control is needed to keep them in place. As a 1200 mm focal length can only be left undriven for 1/5 second, turning rate must be this accurate.

The most common way of driving a telescope is therefore to use a *synchronous* electric motor, which locks on to an AC frequency. Fine control can be provided by slightly altering the supply frequency using a *variable frequency oscillator*, usually with press-button controls to make the rate speed up or slow down slightly.

There are inevitably slight errors introduced by the alignment, the worm and wheel and even by the effects of refraction in the Earth's atmosphere, so some means of controlling the drive rate is essential for exposures longer than a few minutes. A *slow motion*, or fine control, on the other axis is also usually needed for the same reasons, though this is usually a hand operated screw control.

Guiding methods

When you are actually making the exposure using a driven telescope, it is generally impossible to look at the same image that is being photographed, since this would prevent light from reaching the film. So another means of observing the sky has to be provided, so that the fine corrections to the drive rate can be made. There are two main ways of doing this. One is to provide a separate guide telescope, firmly fixed to the main telescope, of at least 2/3 the main instrument's focal length. The other is to observe with the main telescope but to view an object outside the frame.

This technique of *off-axis* guiding is generally the most popular, though finding suitable guide stars is sometimes difficult. Both methods need an eyepiece with crosswires which can be illuminated faintly, known as an *illuminated*
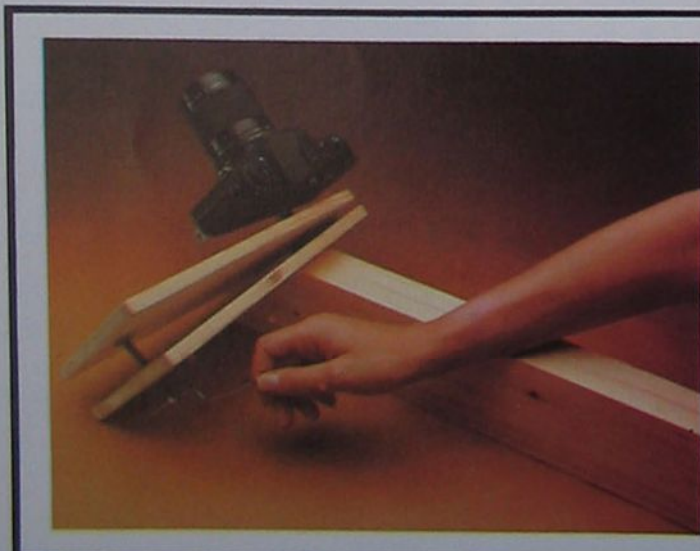
Screw-driven mount *The essence of this is a hinged board at the same angle as your latitude. The screw opposite the hinge is turned once a minute in time with the seconds hand of a watch. This means using a screw of 1 mm pitch 229 mm from the hinge. The wooden spar points polewards. In the southern hemisphere the hinge should be on the opposite side*

reticle. These, and tubes carrying small prisms to intercept some of the light, are sold by telescope manufacturers.

Taking the pictures
When taking an astronomical photograph, the technique is to first check that the telescope is accurately aligned, by observing a star for a period of time. Portable telescopes need careful re-alignment each time they are set up, but a permanently mounted telescope can be relied upon to stay put.

The object to be photographed is then found on a star map and located in the sky. The *finder* telescope, a small low power instrument attached to the main tube, is invaluable in this—it shows the pattern of stars in the area, if not the object itself. Then find the object in the main telescope, usually with the camera already attached, and check the focus—the camera is normally focused by using the rack-and-pinion focusing device of the telescope itself. Next, locate a suitable guide star in the guiding eyepiece—it may be necessary to move the object being photographed away from the centre of the field of view if you are using off-axis guiding.

Once you are all set, it is important to avoid vibration as you open the shutter. A mirror lock is useful, but if your camera does not have one, cover the front of the telescope with a black cloth or hold a piece of card over it while you open the shutter. Allow a few seconds for the vibrations to die away then remove the

cloth or card. This technique requires the driving accuracy of your telescope to be good enough so that the guide star will not drift off in the meantime.

During the exposure, adjust the telescope controls to keep the guide star accurately centred on the crosswires. Some people prefer to use a slightly defocused guide star, and to keep the crosswires in the dead centre of the circular image. Exposure times of 5 to 15 minutes are common, so you must be comfortable for this length of time, allowing for the movement of the telescope. Ending the exposure is a reversal of the starting sequence.

Simpler methods
If you have a driven telescope mount, you can take good views of star fields and so on using a camera mounted on top of the telescope and either a standard or telephoto lens. The guiding requirements are less stringent than for prime focus work, and for focal lengths up to 200 mm you can make simple driven mounts using either electric clock motors or simple screw-driven devices (see box). Exposures of 15 minutes or longer are feasible using these methods, though the longer the focal length the more difficult it is to get good driving accuracy.

Films and special treatment
Virtually any film is adequate for astrophotography, though all conventional films suffer from *reciprocity failure* (see page 466) to a greater or lesser extent. In general, a film of about 200 ASA offers a good compromise of sharpness and short exposure times.

Your choice of film also depends on the object being photographed. Fast films are most suited to faint, extended objects such as nebulae and galaxies. Stars, however, look best on finer grain film, while high contrast, slow film is appropriate to the subtle markings on the planets. Kodachrome or 2415 recording film (b & w) are suitable.

Exposure times longer than 30 minutes are of little use because of reciprocity failure. There are, however, ways of improving the performance of film by *hypersensitizing* it (see page 1338). Baking the film is possible, but the

Andromeda galaxy *The spiral arms begin to show on this 10 min exposure on Tri-X with a 40 cm telescope*

Ron Arbour

results are unpredictable, especially in colour. The film must be removed from its packing before baking, and cannot be wound on plastic spools. Hypering using forming gas is now common—some amateurs hyper their own films while other buy them ready hypered. Another procedure is to chill the film down to dry ice temperatures during exposure. This technique involves many difficulties of its own, such as cracking of film at low temperatures and condensation.

Colour films are usually processed normally, but for best results black and white films that have been given long exposures should be processed in a developer which develops the surface of the grain, such as D-19 or Rodinal, rather than a fine grain solvent developer such as Microdol. Fine grain developers, however, are suitable for lunar and planetary photography.

For grain-free planetary photographs some people sandwich several weak negatives when making prints.

Mars *Save film by putting several images on one frame. A 40 cm reflector was used; exposure time 1/5 second on 2415 film*

Jupiter *This is a one second exposure on 2415 recording film with the 40 cm reflector, used at f/35*
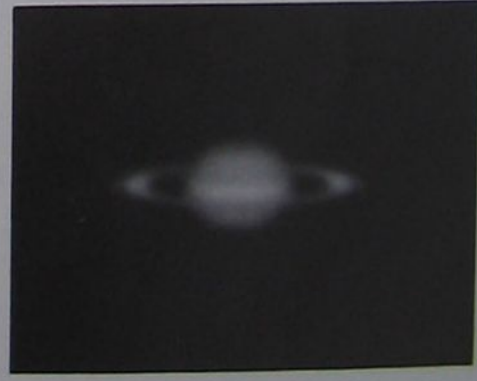
Saturn *Again on 2415 film with a 40 cm telescope, the ringed planet needed a four second exposure*

Ron Arbour

Burt Glinn/Magnum

World of photography

Burt Glinn

The art of finding a striking picture in an apparently dull situation has made Burt Glinn one of America's most famous commercial and industrial photographers

Few photographers have worked on such a variety of assignments as the widely respected New York photographer, Burt Glinn. In over 30 years Glinn has photographed in almost every country in the world on assignments that have ranged from photojournalism and editiorial to travel, advertising and industrial photography. However, he now specializes almost exclusively in work for large industrial and commercial companies, producing the superb pictures needed by his clients to improve their public image.

At one time, company reports were rather plain brochures containing large numbers of graphs and diagrams with little or no photography. Their sole purpose was simply to explain the company's financial position to its
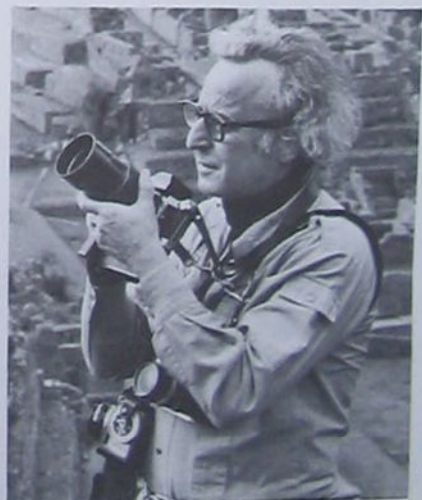
Burt Glinn *travels extensively for over half of every year on assignment*

Dry dock *Shot while on assignment for the Xerox Corporation in Hamburg, West Germany. It shows that strong shots can be found on even the dullest days.* **Kweilin landscape** *A personal picture taken on a visit to China as guest of the Chinese Photographer's Association, when Glinn was President of the American equivalent.* **The trading floor** *of New York's stock exchange shot by remote control on a camera lowered through the ceiling*

stockholders. But, just as commercial advertising became more visually arresting in its portrayal of their products, so corporations began to pay more attention to their own image. They began to use the work of very accomplished photographers to create this image in their increasingly elegant and expensive annual reports. Burt Glinn became one of these photographers and has established such a reputation in this area of photography that it accounts for

Cranberry harvest *Typical of the strong off-beat images Glinn takes for annual reports. Taken for bankers Goldman Sachs who finance the cranberry cannery*

over 80 per cent of his commissions.

Glinn's photography is now almost exclusively colour, although his early black and white photography still influences his attitudes. He is not interested in shooting colour solely for its own sake. The main concern for him is always the content and design of an image. 'If by converting a colour photograph to black and white the design would be eliminated or sublimated then, as far as I am concerned, that picture would fail. I can't deal with something whose only quality is colour.'

Like many photographers who went on to reach the heights of their profession, Glinn did not intend to be a photographer. On the contrary, he initially wanted to be a lawyer. Born in the steel industry town of Pittsburg, Pennsylvania, Glinn majored in cultural anthropology at Harvard University in Cambridge, Massachusetts. He had an interest in journalism and wrote for his university's

prestigious newspaper, but since the paper did not have its own photographer, he supplemented his articles with his own photographs. Although he enjoyed photography, he still planned to study law, but an interview with *Life* magazine interrupted his plans. *Life* had an apprenticeship scheme for writers and were scouring the colleges and universities for promising material.

It was then 1949 and *Life* was the USA's biggest, and editorially most powerful, magazine. Glinn was not impressed. He and his friends thought *Life* too conservative to be considered as the pinnacle of their ambitions and he was disrespectful at the interview. Rejecting an invitation to join their apprenticeship scheme for writers, he told them he would be more interested in taking photographs for them. As Glinn comments, 'I thought that that would be the last I would see of them'.

In 1949, *Life* magazine already had a

Kings of the savannah *Glinn photographed these lions in the Serengeti National Park while on vacation in East Africa. Taken from his vehicle with a 500 mm lens*

Seashore on Bali *Taken on assignment for 'Travel and Leisure' magazine for a story about Indonesia. Glinn travelled around the islands for two weeks*
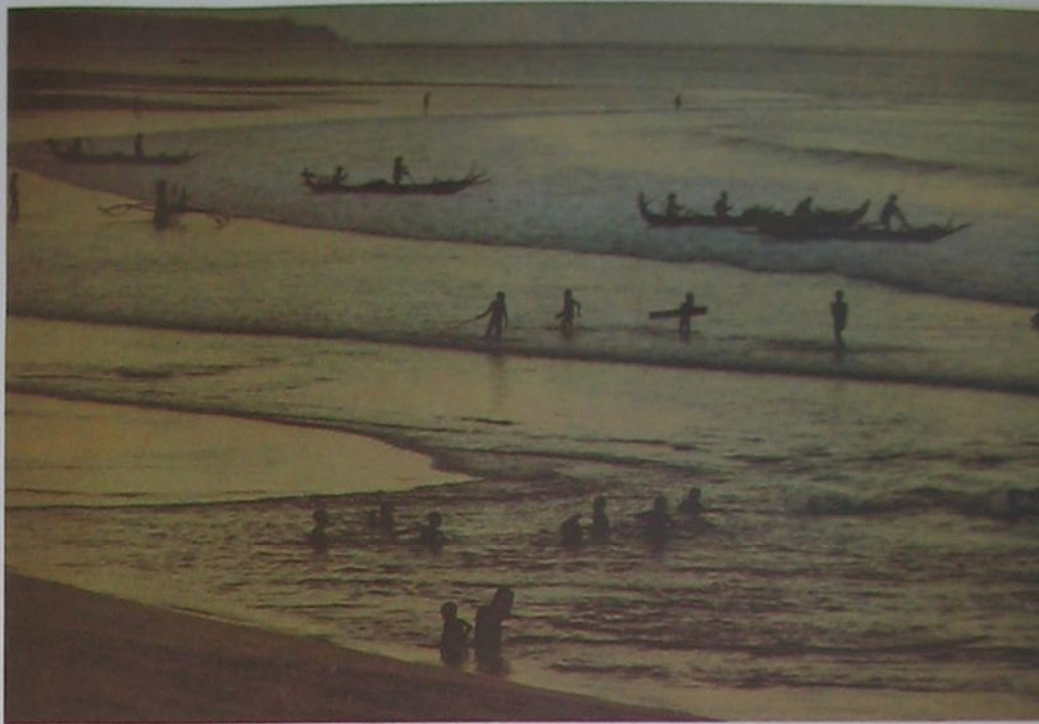
large staff of some of the best photographers in the world, including many recruited from the cultural centres of Europe and from the great Midwest newspapers of the United States. However, they decided to amend their policy shortly after Glinn's interview and invited him to be their first photography apprentice.

Glinn spent the next ten months working as an assistant and the technical training he received could not have been better. Working with some of the world's top photographers, Glinn had to be as technically proficient as the high calibre of *Life's* photojournalism demanded. At the end of this time, however, political changes at the magazine abruptly ended their one-man photography apprenticeship. Although he was invited to stay on as an assistant Glinn already felt that he had learned a lot and made enough contacts to try the freelance photography market for himself. Luck was still with him. The day after he left, the magazine called him and asked him to do some pictures for them—the story ran over two and a half pages. On his third story for *Life* as a freelance photographer he even got the cover. He never did go back to Harvard to study law.

Though working on *Life* magazine was an invaluable experience, Glinn feels that it was his association with the photographic cooperative Magnum that was responsible for his artistic development as a photographer. He joined Magnum in 1952, just five years after it was formed, and was to benefit from the excellence of photographic ideas that were current among its dedicated members. Here his colleagues were such illustrious and influential photographers as Henri Cartier-Bresson, Elliot Erwitt, and Marc Riboud—all to become very good friends. Their attitude

towards photography influenced his development of what he calls 'a complicated unformal sense of design'. He explains this as 'recognizing design in the instant that it occurs. You learn that there is not just one plane in a photograph, but many planes. There is what is happening in front of you but also what is behind it and what is behind that. They are all parts of the design of the photograph. I came to the conclusion that because of who I am and what I'm interested in, my pictures have to have real content—not just information, not just beauty, but content, and that kind of spontaneous design'.

While his technique came from *Life* and his vision from his association with the Magnum photographers, Glinn's professional reputation was most firmly built on his work for a publication called *Holiday*—a large format, serious travel magazine. He started working for it in the early 1950s and continued to do so throughout the life of the magazine. As one of their most important photographers, Glinn travelled all over the world developing the kind of essays that made *Holiday*, together with *Look* and *Life*, one of the major magazines of the United States. In addition to numerous assignments, he also produced two books with the writer Laurens Van der Post, one on Japan and the other on Russia, both published by *Holiday*.

Besides his work for *Holiday*, Glinn specialized in photojournalism during the 1950s and 1960s—covering events such as the Sinai War, Kruschev's visit to America, Castro in Cuba, and the disturbances in Beirut in the late 50s. At that time he considered himself to be,

Burt Glinn/Magnum

Buddhist monks *watch the sunrise over Mt Fuji from the sacred slopes of Mt Sichimen. Taken for a special Japan issue of 'Holiday' magazine shot entirely by Glinn*

essentially, a black and white photographer. But in the 1960s he gradually began to increase the amount of colour photography he did. This was largely due to his continuing involvement with *Holiday*—which was itself becoming a wholly colour magazine. The other major influence on his decision to work almost exclusively in colour was his commercial and industrial report work, which he began in 1967. However, his increasing involvement did reduce the scope of his photography.

Glinn brought to his company reports the eye of a journalist interested in explaining things to people. And by regarding his commercial work as a challenge he earned a reputation for bringing a constant stream of fresh ideas to his assignments. Instead of being content to produce endless pictures of products or aspects of the manufacturing process, Glinn prefers to tell a more complete story.

A good example of this approach is the work he has done for Bristol Meyers, a medical company which manufactures consumer drugs and chemical related products. Glinn has photographed their annual reports for eight years and, over that time, the company has given him almost total creative freedom. As a result Glinn has developed this project, producing a series of superb scientific essays that could just as easily have been published in a glossy magazine.

These essays have been on subjects as varied as cancer research and the production of artificial body parts. All of them are related to the concerns of Bristol Myers. But by approaching them with the attitude of a photojournalist Glinn has achieved some remarkable results. For the essay on artificial body parts, Glinn hired a researcher and then photographed a varied set of pictures—

ranging from an operation to install one of the parts and the manufacture of an artificial heart, to the design of polymer cells for blood vessels and the design of artificial bones. The quality of the essays was so high that many of them were subsequently published by *Time–Life*.

Not all Glinn's annual report work is as rewarding as the Bristol Myers assignments, but even on more mundane jobs he finds there is usually room for new approaches, so that his commercial photography continues to stimulate and interest him. It also has the advantage of taking him all over the world and he estimates that he spends over 160 days in every year on assignment.

Each annual report may take anything between two and twenty days to complete but this is not necessarily done on consecutive days. Rather than flying all

Silhouette *This dramatic shot for the Bristol Myers annual report was taken in a dark corner of a plant making artificial hip joints. 105 mm lens*
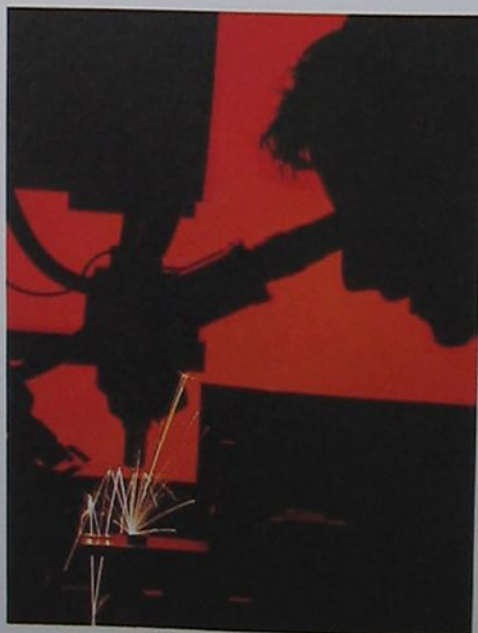
Bali monkey dance *Glinn captured this emotional moment at one of the many religious festivals that take place all over Bali throughout the year*

over the globe for each company, Glinn will organize a schedule that allows him to shoot a number of assignments in each part of the world. 'It saves the plant money and saves me some energy. I find it silly to go to Chile to take just one picture, although sometimes it happens that way. If they want me to do it, I don't object!'

On commercial assignments, Glinn travels with an assistant to help him carry his heavy equipment. He jokes that his assistants start out the year at six foot and end it at five foot ten inches. His equipment is normally three cameras and all the lenses, ranging from a 15 mm to a 300 mm. He also takes enough film to average shooting 20 to 25 rolls of Kodachrome a day—although he has shot up to 75 rolls

on some exceptional stories. Glinn's equipment will usually include a lighting set-up as he often has to take interiors. 'Whenever I can, I use natural light. When I have to use artificial light I try and use it so it doesn't look artificial.'

Although most of Glinn's work is commercial, he still likes to fit in a number of editorial assignments. One of his favourite subjects is what he calls 'social rituals'. For example, he did an essay on the life of the rich for *Esquire* magazine called 'A Gentleman's Paris'.

'I think it's a very good social essay. I'm interested in strange tribes—they may be people living in the Highlands of Papua New Guinea or rich westerners. The people in New Guinea that dress up in bird-of-paradise feathered head-dresses and paint their faces are very similar to the ladies that go to the races in Paris. They just have different forms of expressing their rituals. I enjoy viewing all societies, including my own, as exotic and foreign'.

In his years as a photographer he has made many such social essays all over the world and, one day, he would like to sit down and organize the pictures into books. One would be, he suggests, 'Glinn's version of the variety of religious experience all over the world'. Such a varied career has also meant that his photographs have been used in almost every conceivable way. He has little preference for how the work is used 'just as long as I can get it back, make prints and hang them on the wall. My only problem now is finding enough walls'.

Glinn's success as a photographer is due not only to his imaginative ideas and talent for photo essays but also to his ability to infuse a sense of design, irony and an unconscious symbolism into his photography. There often seems to be a strong symbolic element in his pictures, but Glinn dismisses the idea that this is deliberate. 'Conscious symbolism gets pretentious. If you have your own sense of irony—of what is appropriate or inappropriate in the world—you recognize things. There is a lot of symbolism in my work but it comes from my visual memory, some innate sense. You recognize, you do not create, symbolism. It emerges from your own sense of the irony of life.'

However, he values this sense for the extra information it provides. His photographic objective is always to help other people to see better. 'A photograph is a shared experience. Somebody should be able to look at it and get some kind of information from it. But besides the factual information of the subject, the viewer should also get a new sense of visual order, some visual information that teaches him or her how to look at the world. Through photography, I learned to see differently and it has enriched my life a lot. I hope it will enrich the lives of others.'

Lens design

No lens can fit every bill and, in creating a new lens, designers must carefully play off a variety of features, such as speed and compactness, to achieve a product that matches the photographer's needs precisely
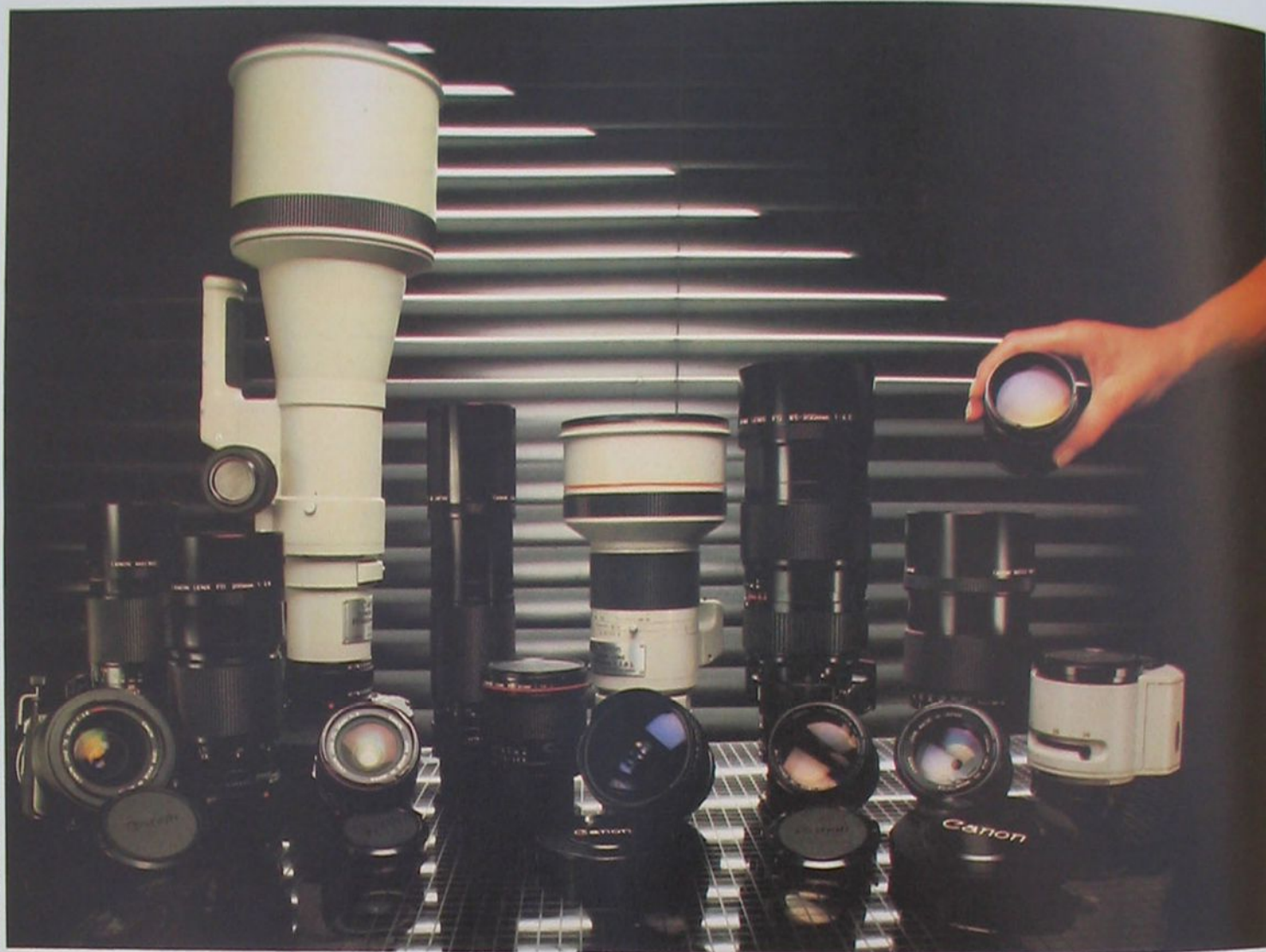
Dave King/equipment courtesy of Canon (UK) Ltd.

Inevitably, there are limitations to the standard lens normally supplied with a camera. Some may find that its angle of view is too limited; others object that it is too slow, does not focus close enough, or that it could be made cheaper and optically better by reducing the maximum aperture.

There can never be a universal lens, but the standard lens comes pretty close —it is the only lens many photographers will ever use. The basic soundness of the standard lens—on a 35 mm SLR, normally a 50 mm $f/1.8$ focusing down to 60 cm—is confirmed by the diversity of the complaints. It can be made more suitable for a particular purpose only by compromising on another; the trade-offs include speed, resolution, close focusing, distortion, aberrations, and cost. A very in-structive exercise is to consider various specialized lenses for particular purposes, and see how well the standard lens is an acceptable compromise.

Angles of view

Some subjects can be framed fully only by the use of a wide angle lens. Many people prefer the extreme angle of view given by these lenses, which also give a greater margin for error in focusing, but for two reasons they are not used as standards.

The first reason is that good coverage and edge definition are achieved more easily with longer lenses. This is seen at its most extreme in the two-element long-focus lenses from Leitz, which provide superb definition from the simplest of designs. The second is

Long, wide, fast, slow *Manufacturers produce a vast number of lens designs to give the variety of specifications demanded by different types of photography*

that the reflex mirror of an SLR camera would be obstructed by a wide angle version of this lens.

To illustrate the problem, imagine a lens of 40 mm focal length which is 20 mm from front to back. If it is of symmetrical design, the *rear nodal point* (from which all measurements are taken) is 10 mm from each surface or halfway between the front and back surfaces. At infinity focus, the nodal point will be 40 mm from the film plane. Of this, 10 mm is taken up by the lens, so there will only be 30 mm for the mirror to swing up.

Although it is possible to build a 40 mm

Wear-resistant materials *should be used for heavily used parts such as the lens mount, but they are costly and hard to work*

lens only 20 mm thin (or even thinner), it requires a simple Tessar-type construction, which limits the maximum aperture to about $f/2.8$. Faster lenses are thicker, and must therefore be of greater focal length. A typical value is 50 mm, and for ultra-fast $f/1.2$ lenses it is not unusual to find a length of 55 mm or 58 mm.

So designs of lenses wider than 40 mm had either to do away with the mirror of an SLR or use a *reverse telephoto* design with an additional negative lens group in front of the main group. Inevitably, a reverse telephoto design leads to greater expense, complexity, and size, and compared with a non-retrofocus (straight) design, there is normally a loss of resolution and an increase of both flare and distortion.

On non-reflex cameras, non-retrofocus wide angles are feasible at 35 mm focal length, and most compact cameras use 35 mm or 40 mm lenses. Many makers once supplied non-retrofocus wide angles to be used on reflexes with the mirror locked up. Nikon's 21 mm $f/4$ and Canon's 19 mm $f/3.5$ were of this type until the late 1960s, when acceptable reflex lenses in these focal lengths became available. The 21 mm $f/4.5$ Biogon had been available for the Contax since 1955. To this day, Hasselblad offer a choice—the 38 mm $f/4.5$ Biogon in the SWC/M non-reflex and the considerably more expensive and optically inferior 40 mm $f/4$ Biogon for the reflexes.

If you want a lens of focal length significantly longer than about 58 mm, on the other hand, you are confronted by a different set of problems. Optically, the lenses are easy to design but inevitably, they are larger than lenses of shorter focal length. An 85 mm lens with the comparatively modest aperture of $f/2$ is substantially large, and grinding and mounting such pieces of glass is expensive.

With focal lengths much greater than 135 mm, the barrel length can become unwieldy compared with a standard lens. This inconvenience can be accepted: the Leitz 560 mm $f/6.8$ Telyt is a two-glass non-telephoto design of superb contrast (important in a tele lens) and optical quality but is very long indeed. There are, however, two ways to achieve a more compact lens. The first is to use a negative rear (telephoto) group to shorten the back focus, but the extra elements result in greater expense, lower contrast, and (usually) poorer image quality. Up to 135 mm or so, non-telephoto designs are better.

The second method is to use mirrors to fold the light path (see page 2208). Mirror lenses are compact and handy but have the major drawback of a fixed aperture.

Another alternative is the use of a zoom lens, but its only advantage is con-

Keeping a close check *on specifications helps to ensure that the lens is within the limits intended by its designer and user*

Lens resolution *is assessed on a large screen (about 3 m in front of the lens), on to which a grid (above) is projected by the lens*
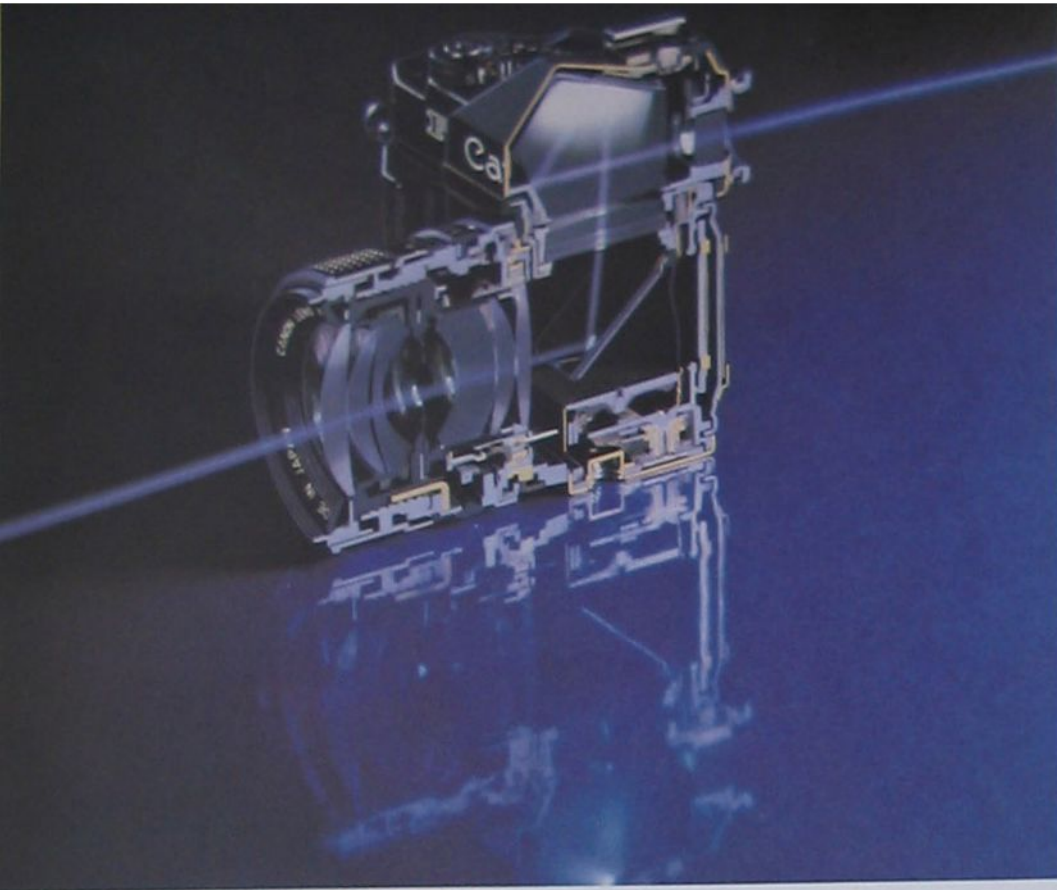
Precision assembly is just as important for making a good lens as top quality components, made from the finest materials

time and some modern zooms are compact.

Speed

A good *f*/2 lens of 50 mm focal length can be made with six elements, standard optical glasses and easily ground spherical curves. For increased speed, the designer must use more elements, more exotic (and expensive) glasses, and perhaps aspheric lens surfaces. For even greater speed, the design might also compromise on certain other optical qualities. For example, an *f*/2 lens is likely to have a far flatter field than an *f*/1.4 from the same maker, but only an extravagant or unwise photographer would buy an *f*/1.4 for copying, when an *f*/2 is adequate. So few fast standard lenses will give a field quite as flat as an *f*/2 when used at maximum aperture. The optical quality of fast lenses is inevitably poor at full aperture (see page 212), though it is usually acceptable for general purposes.

The faster lens is larger, heavier and more expensive: one well-known manufacturer's lenses double in price from *f*/1.8 to *f*/1.4, and double again to *f*/1.2. An *f*/1.2 can weigh twice as much as an *f*/2, and has limited usefulness unless you often take pictures in low light levels.

The same is true of the longer focal lengths. Compare, for example, the tiny 90 mm *f*/4 Elmar for the Leica with the 90 mm *f*/2 Summicron, or the 300 mm *f*/2.8 Nikkor with its *f*/4.5 stablemate. Furthermore, close tolerances are difficult to achieve with massive pieces of glass, so assembly is expensive.

venience. Even the best zooms compare unfavourably with the best fixed focal length lens, and some are very poor indeed. The greatest problem is that photographers expect too much from a zoom—a long zoom range, high speed and compactness.

From the point of view of image quality, one of the best zooms ever made was the Vivitar Series 1 90–180 mm *f*/4.5 Flat Field. With 18 elements in 12 groups, a weight of 1.09 kg, and an overall length at infinity of 158 mm, it was large and heavy, and also extremely expensive. The zoom range of only 2:1 is not impressive, and *f*/4.5 is certainly not fast, but the results were excellent. However, zooms are improving all the

Aperture diaphragm *The leaf design has proved to be reliable and convenient, so it is used universally*

A lens aperture *can be checked by comparing the diameter of a light spot on film printed with the standard aperture*
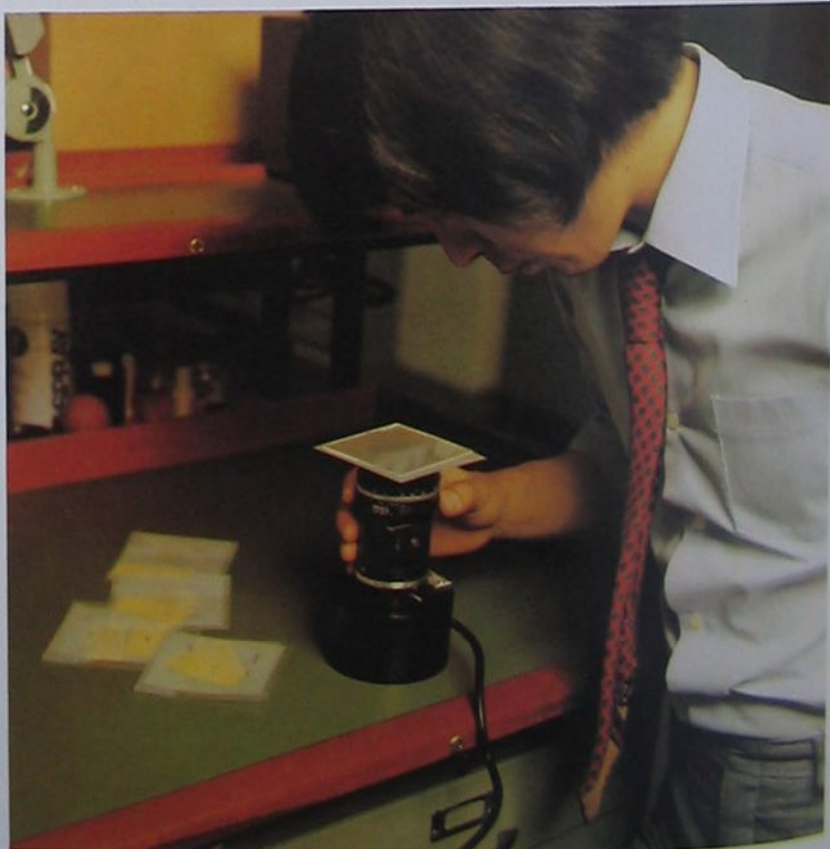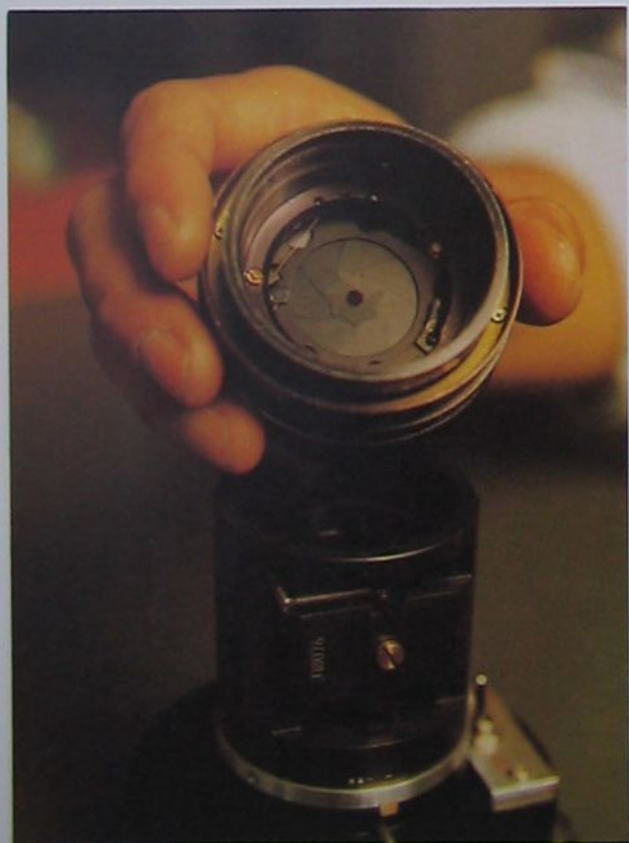
It is not particularly difficult to make non-retrofocus wide angles reasonably fast. Indeed, the 35 mm f/1.4 for the Leica M is actually cheaper than the 50 mm f/1.4. But the requirements for high speed combined with those for reverse telephoto construction are excessive. Interestingly, although Nikon lenses are usually appreciably cheaper than Leitz's, the 35 mm f/1.4 is much more expensive than the Leitz equivalent.

A major drawback of ultra-fast lenses, especially of 90 mm focal length and above, is the reduced depth of field. Even at 50 mm focal length, a one metre head and shoulders shot entails a depth of field of 67 mm at f/2.8, but only 28 mm at f/1.2. For an 85 mm lens used at the same distance and apertures, the figures are 23 mm and 12 mm. For this reason, mirror lenses have become slower over the years. The 1000 mm f/5.6 Mirotar has only half the depth of field of the 1000 mm f/11 Nikkor at any distance.

It is much easier to build slower, rather than faster lenses, but a major drawback is that photographers want as much speed as they can afford. This accounts for such odd maximum aper-

tures—f/1.7, instead of f/1.8, a difference of about 12 per cent in light transmission. There is some truth in the belief that faster lenses are easier to focus on an SLR, but with modern bright screens this is not important. Many Nikon owners use the 55 mm f/2.8 Micro Nikkor as a standard lens.

There is no great need to build slower lenses simply for higher resolution and less distortion, because a 50 mm f/2 design can be virtually distortion-free and have a resolving power greatly exceeding that of any film on the market. Demanding higher speeds of the design, however, can result in dramatic image deterioration for only small gains in speed. Modern f/1.8 lenses are as good as f/2s of the 1960s, because of computer aided designs and improvements in glasses, but 'stretching' the design still further to, say, f/1.6 (a gain of about a quarter of a stop) is a rash move.

Many relatively slow lenses offer better contrast than some faster ones, especially at the longer focal lengths. But the slow speeds of the ultra-high resolution lenses (such as the Micro Nikkors) are due more to the need to maintain correction and field flatness at close distances than to any increase in resolution. Often, a six-element design used one stop down at f/2.8 will give superior image quality to a four-element design used wide open at the same aperture.

For any focal length and lens design, there tends to be a popular maximum aperture, which combines resolution, speed, freedom from distortion and cost in a way that is attractive to the average buyer. Anything faster than this tends to be either too expensive or of inferior quality; anything slower simply does not sell. There are a few designs, however—notably in retrofocus wide angles and zoom lenses—in which the optical and marketing requirements are opposed. In these two instances, a good general rule is the slower the better.

Close focusing

A standard lens can be designed to focus down to remarkably short distances, but for a number of reasons, it is better to make lenses specifically for close-ups.

The main demand on a lens for close-up work is the mechanical extension of

the focusing mechanism to allow the lens to focus on nearby objects.

An extension of about 6 mm is needed if a 50 mm lens is to focus on 50 cm; for 250 mm, the extension is about 13 mm; and if a 50 mm lens is to focus down to 10 cm from the front glass (as would be necessary for a 1:1 true macro shot), the extension should be 100 mm. Most macro lenses compromise with a 75 mm extension, which allows a 1:2 (half life size) picture—more than 12 times the extension for a normal close focusing limit.

Extra focusing travel is not the only criterion for a macro lens, however. An ordinary standard lens is designed to give its greatest freedom from aberrations when focused on a considerable distance, while the starting point for a macro lens is in its close-up mode. A macro lens will focus on infinity, but it may not perform well at this range.

If a lens is focused closer than about ten focal lengths, the effective focal length is extended to such a degree that the marked f-numbers no longer hold good. At ten focal lengths, the effect of the extension is just noticeable—about a quarter of a stop. At five focal lengths, it approaches two thirds of a stop, and so unless a correction factor is applied either manually or automatically (as happens with some Micro Nikkors and some zoom lenses) significant under-exposure results.

With long focus lenses, the ten focal lengths rule holds good, and the extensions required are substantial: to focus a 200 mm lens on 2 metres requires a 20 mm extension. Long focus lenses also bring home the problem of depth of field at close distances. A 200 mm lens focused on 2 metres has a depth of field of 24 mm at f/4.

Clearly, then, lens design remains very much a compromise—no lens can suit every photographic purpose. Yet as designers introduce new materials and improve on existing designs, lenses are becoming more and more versatile—fast telephotos, for instance, are much more common then they were. Even the standard lens is very versatile.
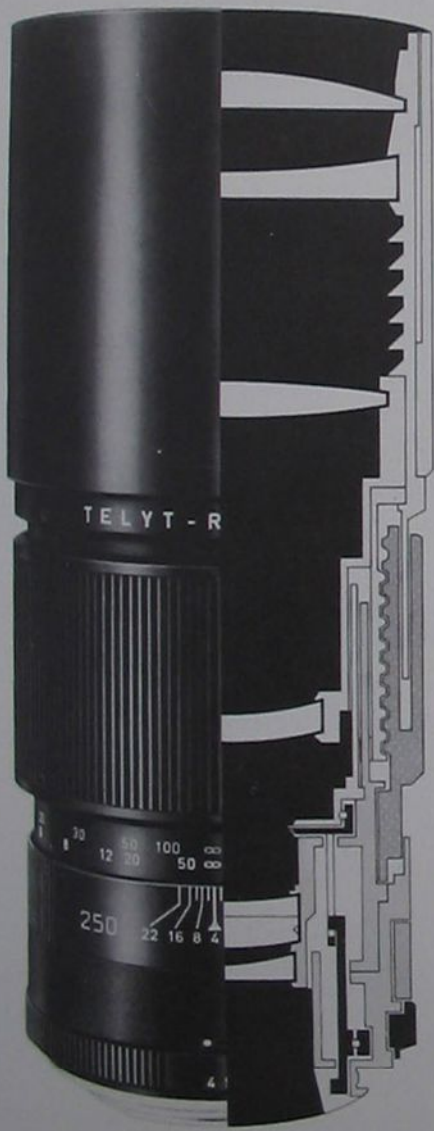
The Leitz Telyt-R 250 mm f/4 *employs a helical focusing mount to achieve a focusing range from infinity to 1.7 m*
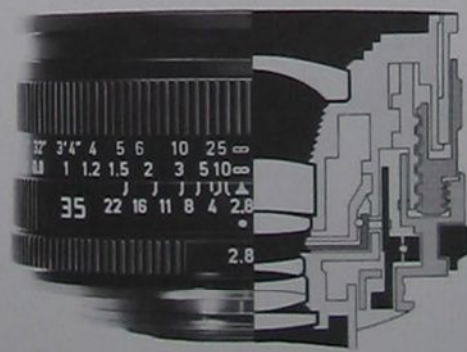
The Leitz Elmarit-R 35 mm f/2.8 *offers high contrast and excellent resolution, even when used fully open*
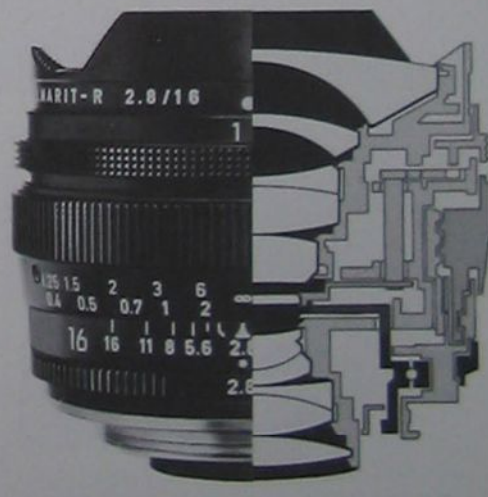
The Leitz Elmarit-R 16 mm f/2.8 *is a fisheye (note the built-in hood) that gives an image right into the corner of the frame*

Preserving your old photos

Valuable old photographs must be restored by a professional, but fading snapshots from the family album can be given a new lease of life by a combination of gentle cleaning and copying trechniques

Copying a black and white print *Rather than attempt chemical work on valuable collector's items such as these autographed but mass-produced publicity prints, make copies using yellow or blue filters over your camera or enlarger lens*

Most people have old photographs of one sort or another. They may simply be your own early photos, or those taken by your parents, for which the negatives have been lost. Or you may be lucky enough to discover some genuinely old prints inside secondhand books or in the attic, or perhaps a box of glass plate negatives.

If you do come across any old prints, be extremely careful when handling them and, if you have any suspicion at all that they might be of historical value, take professional advice. Old photos are very fragile and easily damaged and you should never attempt to restore anything of value yourself. Restoration is very skilled work calling for years of experi-

ence and, without the proper knowledge, you could destroy an irreplaceable image simply by removing it from its resting place. However, once you are certain that the photo has no intrinsic value, yet you still wish to preserve the image—perhaps because it shows your mother as a child or even because it is simply a nice picture—there are a number of steps you can take.

All too often these old photographs are in poor condition through careless storage or inadequate fixing in the first place. You might think that the best thing would be to treat them chemically, but in fact this is often the worst thing you can do. For example, in a box of faded glass negatives, silverfish and other pests may

have eaten and soiled the emulsion, making them appear fogged or giving dirty highlights. If you try to clean them up by bleaching, a chemical reaction may start between the bleach solutions and the deposits on the emulsion making holes in the photo.

So chemical treatment of the photo is out of the question. Indeed, you should handle the original as little as possible. Keep the photo in subdued lighting as much as possible and never expose it to direct sunlight for any length of time. Usually, however, you should be able to

Rescuing an old negative *A treasure trove of old negatives may reveal those which are scratched, badly stored or simply suffering the effects of age—such as the 'bloom' of dichroic fog, or yellow stains. This one was carelessly masked*

Cleaning an ambrotype *Although each one is an 'original', ambrotypes were produced in their thousands. Some may benefit from cleaning and rebacking, before being remounted in their original frames. This example has a painted backing*

clean the photo very gently. But do not wipe them with harsh cloths or damp rags—use soft, lint-free cloth or a blower brush to remove surface dirt. Before you do anything more, make a straight copy (see page 1121) so that, should the original deteriorate in any way, you have a permanent record.

If, after gentle cleaning, the photo is still in rather poor condition, you may wish to do something to improve the image a little. In this case, you can make a second copy and work on this rather than the original. You may even be able to make the necessary adjustments while making this second copy.

Making copies

For stained or faded originals, copying is by far the best method of recovering the image. Using your enlarger (see page 1171) or copying set-up (see page 944) you can produce duplicate negatives and positives and by careful control of exposure and development you can increase or decrease the contrast. You can even improve on an original mono-chrome image by copying it, producing a bromide print and hand colouring it—thus obtaining a coloured print from what may have been a faded, torn and forgotten original.

Many old negatives were quite large. If you have one that is too big for your enlarger—and you do not have a light-box, so cannot make a backlit copy—you could always use a large sheet of ortho-chromatic film to produce a duplicate positive—or negative—by contact print-ing. Use your enlarger as a controllable light source by racking the head and negative carrier up to the top of the column. This gives the widest spread of light. You can cover the enlarger lens with a piece of greaseproof paper to diffuse the illumination.

Using orthochromatic film allows tray development in safelighting, which gives you greater control over the image contrast during development. If your original has got fixer stains on it or has yellowed with age, you may need to use a yellow filter when copying it on ortho-chromatic film.

You can hide cracks or tears in an original by careful application of your retouching skills to the duplicate nega-tives and prints. For example, if you have a scratched and tarnished tintype (also called a ferrotype but not to be confused with ferrotyping, the term applied to glazing) you should start off by copying it

1 *Use tepid water or a spirit-based cleaner and very gentle brushing to remove surface grime such as sticker gum*

2 *Use a hardener presoak—or refix—if further chemical work is needed before washing, drying and remounting*

3 *A print can then be made before storing the negative in a proper negative bag. Or a copy negative can be made*

1 *Carefully prize loose the frame and pressings of the ambrotype. Notice the painted black backing has failed here*

2 *Remove dust, grime and the flaked backing using spirit-based cleaner. Restore the backing using black paint*

3 *When the backing has dried, reassemble the ambrotype using the original frame and decorative pressings*

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with polarizing filters over both the light sources and camera lens. This will leave your final print with only dark or light blemishes to be removed. The dark blemishes can either be knifed out or, more easily, you can opaque the corresponding clear spots on the copy negative, then do the more exacting work on the final print. Using a diffuser enlarger to print always helps in these situations.

Although copying can improve the technical quality of an image, a certain authenticity of character and subtlety of tone may be lost in the process when using today's high speed materials. One possible solution to this point is to print the copy negative on to period style papers using old fashioned processes such as bromoil printing (see page 2196)

or even platinum printing (see page 2360). The long tonal ranges of these processes help recreate the atmosphere and bring a richness of character to the image that might otherwise be lost.

If you have a glass negative plate that will not fit your enlarger you can copy it by supporting it over an illuminated white background. Use colour transparency film to preserve the quality and character of the original. This method is very useful for copying ambrotypes as a safety precaution before attempting to replace the backing. An alternative method is to make a colour print from a colour or black and white copy negative.

Ambrotypes and daguerreotypes

An ambrotype consists of a thin glass negative with a black felt or paper backing, so it appears to be a positive image. The whole thing is usually held in an ornate glazed frame made of brass. Often the pieces have come loose with age so take care when opening the frame. The most common blemishes are frame tarnishing, holes in the backing

and dirty glass.

You can use an old toothbrush to clean the frame, but avoid polishes whose fumes could damage the image. The outer glass can be washed in mild warm soapy water, and the backing can be replaced with new felt. The plate with the image must be handled only by the edges, but you can wipe the plain (non-emulsion) side with a chamois.

When dismantling the ambrotype make sure that the backing is a separate component to the plate. Some photographers used to paint the plate instead of using black felt or paper. In some cases the paint was even applied on the emulsion side, and in this event you should do no more than wipe off the dust and polish the frame—even the experts have trouble in identifying the paints that were used.

A daguerreotype is similar in that it has a glazed frame, but the image is on the surface of a copper plate and no backing is needed. The frame can be cleaned, as with ambrotypes, but the glass is often taped to the copper plate. This must be gently cut away to allow cleaning of the glass. The tape should be replaced with acid-free archival linen tape as supplied by specialist art suppliers and photographic shops.

The old chemical method of cleaning the copper plate used thiourea (thio-

Print and image preservation *Although a century-old photo such as this albumen print may be a highly prized feature of your collection, it needs careful restoration before it can either be handled and displayed, or kept with other work*

1 *The first step when working with a potentially 'significant' or valuable image is to make a copy image—just in case something goes wrong*

2 *Clean the print very carefully with a non water-based film cleaner—and not water since this would swell and soften any emulsion. Use cottonwool swabs*

3 *Remove the print from its mount only if you feel that this will improve its chances of long-term survival—and if it comes away easily. Take care not to cut the print*

4 *Remount the print after removing any traces of its former mountant. Use 'dry' methods. Make a clean copy of the print if you wish to display it*

5 *For storage, place the original in a folder of acid-free paper inside a suitable print box. The box should be kept somewhere cool and dry*

Tim Stephens

carbamide), but even dilute solutions have been known to cause corrosion that destroyed the plate within 18 months. So it is best to avoid this method.

Precautions

If you have in your collection an old faded image on printing out paper then you will need to take special care when copying it. Although many of these papers were fixed or toned to be light safe, some were not. So to be on the safe side you should put a yellow filter over the light source when copying to prevent it from being fogged by the intensity of illumination—even if you use a flash.

You may discover negatives that are brittle and yellowed, and smell slightly acrid when you retrieve them from an airtight storage space. These may well be on nitrate film base. Another feature of nitrate base is that it becomes abnormally sticky when in the advanced stages of decomposition.

Nitrate base can be a considerable problem. Manufacturers stopped producing it between 1940 and 1950 because it was highly flammable. If you have any negatives on this material it is best to copy them and then dispose of them, keeping them in individual polythene bags until you can do so. It is important to keep them separate because several together could cause an explosion. If you have more than a dozen or so it may be worth getting your local authority to dispose of them because of the risk involved in simply leaving them for the normal refuse collection.

Fogs and stains

It is quite possible that you will come across an old negative which shows signs of fading or fogging. In the case of fading—perhaps caused by the long-term effect of salts which should have been properly washed from the emulsion—perhaps the only thing you can do is make a contact or enlarged copy (via a positive). Fogging in the form of stains can sometimes be 'cured' in the same way—but chemical treatment must again be avoided.

Negatives which have dichroic fog—noticeable as patches that appear red-violet by transmitted light but green-yellow by reflected light—may also be copied, but you could try using a yellow or blue filter to minimize any actual effect on the image. A brief rinse in very weak reducer can also help.

Yellow stains on more recent prints are either caused by silver sulphide discoloration (see page 1246) or by inadequate or inefficient fixing. In both instances you should thoroughly wash the print before selenium or sepia toning it. If it is poorly washed then patchiness will result. In all cases, before attempting treatment it is wise to make a copy of the original in case the image is spoilt in the process. Remember also that old photographs are often fragile and those fading originals could be lost for ever if not treated with great care during restoration or copying.

School photo Colour photographs of sentimental value can be cleaned and copied to give them a new lease of life. This example is faded, stained and dirty—definitely not the sort of picture for the family mantelpiece or piano top in its original condition

1 *Start by unframing the photograph— some types are pinned together, others are taped. Take care not to damage either the frame or the backing board*

2 *You may find that much of the dirt and grime which spoils the picture is in fact on the cover glass, so clean this using a moist cloth of soapy water or spirit*

3 *Also clean the print, using a swab loaded with film cleaner, ready for copying and reframing. Notice the fading where the print has been uncovered*

4 *The fading on this 20 year old colour print has affected the cyan content of the image— confirm this by looking through viewing filters*

5 *Make a copy negative through a weak (05, 10, 15 or 20) cyan filter. Make sure the copy film is balanced to the exposing light. Use this to make a copy print*

6 *Mount the copy print and remount the original before framing. The original can then be put away for safe storage while the copy can be used for display*

Tim Stephens

Ian Berry/Magnum

Corner *Ian liked the shapes of the road and buildings at this corner and waited for over an hour until passers-by completed the composition. Even then he was not entirely happy with the shot, calling it 'a near miss'.*
Bridge *While taking photos of Coke cans rusting in the river, Ian looked up and spotted the man on the bridge. The relation between man and statue made the shot and Ian grabbed it on a 350 mm lens, hand held at a fairly high shutter speed*

TOWN SCENES

Ian Berry specializes in making extraordinary photographs of ordinary people. These shots from a day in Dumfries show what a quick eye and great patience can make of an everyday town

Ian Berry, one of the photographers in the elite Magnum Agency (pages 112 to 117), gained widespread acclaim a few years ago with the publication of *The English*, a record of ordinary English people and their lives. Recently, for a slightly different angle, he spent a day in Dumfries in the south of Scotland.

'I had read about the town before going,' he says, 'and I started by looking for basic photos of local landmarks such as Robert Burn's grave. These planned shots, however, came to nothing and I ended up just wandering the streets'.

Ian's equipment has to be light and quick to operate so he uses a combin-

ation of Leica and Olympus bodies with 28, 50 and 135 mm lenses and also a 350 mm mirror lens which he uses rarely but carries around just in case.

'As a rule I like to spend several days getting the feel of a new place and trying to see it in depth, finding out what people do, how they spend their time. With just one day available I tried to assemble a selection of photos which would give a good 'surface impression' of the town and its people.'

While wandering through a new location Ian uses a combination of two basic techniques. Firstly, he keeps a camera constantly ready for a situation which

Junction *The jumble of street signs and road markings at this junction of a small town amused Ian but a focal point of some kind was needed. The boy poked his head out to look at Ian and the composition clicked into place.*

Shoe shop *This photograph calls for two completely different responses. The viewer is drawn to look at the street scene but is at the same time being watched by the shop-assistant. The overall effect is deliberately unnerving.*

House *The photo is made by the contrast between the wavy lines of the road and the rugged solidity of the house. The two solitary figures heighten the feeling of isolation*

Ian Berry/Magnum

Bicycles *Ian saw the potential in the collection of basic shapes, circles, squares and triangles which fill the frame, and shot when the man's posture made another shape of his legs, linking him to the scene and completing the composition*

Stetson *The peculiarity of a Stetson in Dumfries caught Ian's eye immediately. This mark of the oil boom, a new style in an old town, adds humour to the series. Unexpected shots like this always complement the more evocative photos*

suddenly presents itself and grabs it before it disappears. The second technique is more studied and methodical. Ian finds a situation which offers a good basic structure or framework and then waits for as long as it takes, which can mean an hour or more, until people come by to complete the composition he has in mind.

Ian found the town somewhat depressing and his sombre response can be seen in the photographs he took.

'It has a beautiful river but it was knee-deep in cans. It could have been such a lovely town but it seemed unable or unwilling to make the most of its potential.'

While yearning after exotic locations and grand events, it is easy to neglect the photographic potential in ordinary scenes and ordinary people. Many of these photos might seem unremarkable to the average inhabitant of Dumfries, but to people living in different environments they provide an interesting study of a people's everyday life. And this is an interest which will increase rather than decrease with the passage of time as social historians in the future look back.

What went wrong?
Leaves

Whether fresh and green or autumnal and coloured, leaves make good photographs. Ian McKinnell comments on four varied attempts
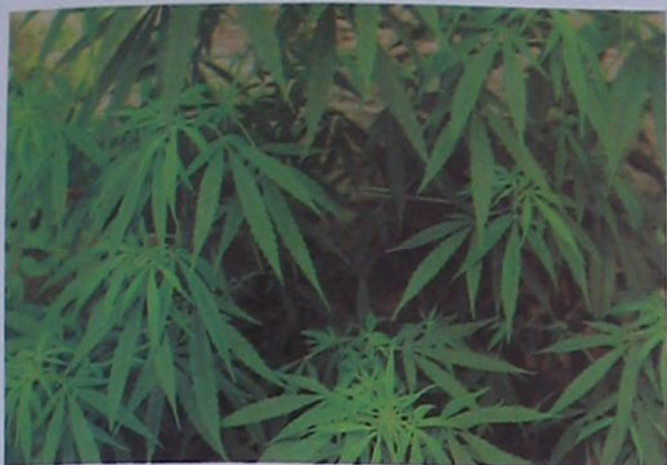
When a photograph depicts something with a personal or social significance we may tend to view it in a slightly different way. This photo depicts cannabis and this fact may influence some people's reaction to it. In this shot the photographer has taken a straight shot of the plant rather than drawing attention to its use (perhaps by using distortion to suggest hallucination) but poor technique has lessened its impact. While we can see that the plant has beautiful colouring, the shot has been poorly framed. The all-important central area is simply a hole, and the best example of foliage, at bottom centre, has been brutally pruned. I would have closed in on this, looking for shapes and patterns and excluding ugly details such as the wall in the background

Of the four photographs presented here I find this the most interesting and successful. The soft diffused lighting is perfectly suited to the muted colours and the complex forms of the leaves—direct sunlight with its harsh shadows would have ruined the delicate feel of the shot. Nevertheless, tighter framing at the top, particularly on the left, would have avoided the distracting ragged edges. Also the photographer should have stopped the lens down further so that the whole shot was sharp. As it is, the leaf at the front—perhaps the most important element in this subtle composition—is fuzzy
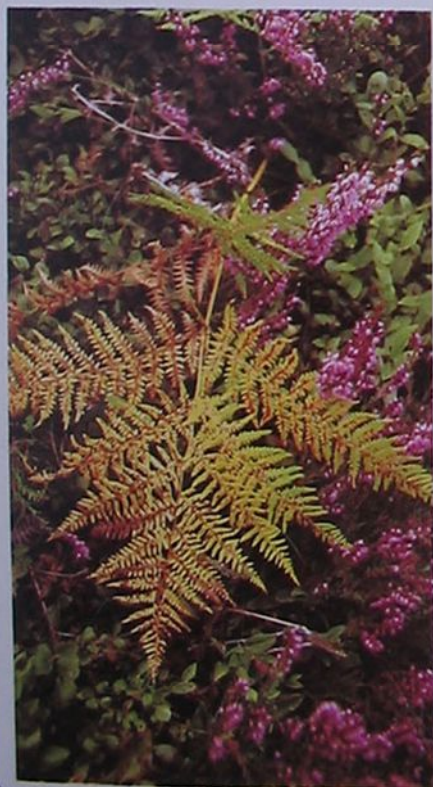
I find this photograph messy and cluttered. The two main elements—the fern and the heather—fight against one another and one's attention wanders between them. It would have been better to decide which was the most important and concentrate on that. For example the photographer could have moved the fern to a better background, or perhaps even taken it home to photograph at leisure. Photographing things where you find them is not always the best approach. If you can, try taking some of the things you find back with you. But please be careful what you pick as many wild flowers are scarce

This could have been a much better photograph but the photographer has failed to exploit the high potential of the subject matter. Most immediately noticeable is the banal composition, bisecting the image and leading the eye straight out of the picture—this could almost be two unrelated shots joined together. The rich colouring of the brick wall and the riotous conglomeration of the leaves both offer promise but juxtaposed in this way they fail to complement each other in any way. The most interesting area for me is where the red stem joins the sycamore leaf, with its fascinating variations in texture and colour. I would have used a macro lens to exploit this classic example of complementary colours, clearing some leaves from the background to emphasize shape and using the harsh light to bring out the colour and texture

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Vautier/de Nanxe

Precision exposures-1

Most photographers are satisfied with less than perfect exposure, but the extra sparkle that marks out a spot-on exposure makes all the extra effort needed for precision worthwhile

Exposure with most of the popular cameras is automatic, so people tend not to give a second thought about the exposure they are giving. Even when photographers use separate, hand-held meters (see pages 541 to 545) they still tend to just take average readings. But for perfect exposure every shot you need to take a little more time and care.

The most sophisticated metering and exposure method—the zone system—is dealt with in a subsequent article. But before attempting to come to grips with the complexities of the zone system it is worth looking at a few simpler methods which could improve your metering technique, and so improve your results. These range from simply changing the film speed setting, to looking more

Statues *Giving a shorter exposure than that recommended by a TTL meter can help to retain the maximum shadow detail possible without burning out highlights*

closely at the tones in the subject.

The following guidelines are intended mainly for use with a hand-held meter. Although they can be adapted for use with built-in TTL meters, this, strangely enough, involves a lot of extra effort. If you are really serious about exposure you really do need a separate meter.

The best type of meter is one which has an exposure dial, rather than a digital readout. The Weston is generally thought to be the best for this type of work. Unfortunately it is no longer made, but it is possible to modify your meter to

give features similar to the Weston. This principally involves making extra marks either side of the main arrow. These are at one stop intervals (see box).

Another point to bear in mind is that processing should be strictly standardized. All the care you have put into metering and exposing can be wasted by erratic development. With colour work the processing is standardized anyway to avoid problems with colour shifts.

In black and white work, however, the situation is not so simple, as you may want to alter the processing to suit the subject. With contrasty subjects, overexposing and underdeveloping gives a better range of tones. With subjects which have a small tonal range you may want to increase the contrast by under-

exposing and overdeveloping. If you want to do this sort of thing then you must standardize on a few set procedures. You can then concentrate on exposure control alone.

Changing speed

An essential part of any advanced metering method is being able to imagine what the effect of the exposure is going to be—that is, the ability to *previsualize* the result. This is, of course, affected by the film. But even the equipment itself can affect the result, and you must know what effects your lenses and shutters have so that you can make allowances for them. This can only be done by trial and error, and by carefully evaluating your results. But there are certain factors you should look out for.

Silhouette *There is often no 'right' exposure—it is for the photographer to decide whether he wants shadow detail or a strong silhouette*

The accuracy of your shutter speeds may vary, depending on the speed set. To take a common example, the 1/500 second top speed of a leaf shutter is frequently nearer 1/350 second. Lenses also vary in the amount of light that they transmit. Zooms in particular tend to transmit less light than is suggested by the marked f-numbers.

These equipment variations added to variations in meters and personal techniques mean that it is by no means unusual for serious photographers to find that manufacturers' recommended film speeds do not work for them. With 64

Street scene *Sometimes you have to accept overexposure of highlights and loss of highlight detail in order to achieve the best possible shadow detail*

ASA (ISO) Kodachrome, for example, it is common to find people using an exposure index of 50 or 80. With black and white films still wider variations are found.

This 'fine tuning' of film speeds does not mean that there is anything wrong with either you or your equipment. It simply means that your working methods, your subjects, and the equipment and materials you use require a slight variation from the standard.

Using the meter

Once you know how your film and equipment affect the picture, and have determined suitable exposure indices for your type of work, you can use this information when metering.

There are four basic types of metering —reflected light readings, incident light readings, brightness range method and keytone metering. The way these are used for most conditions is described in other articles, but for unusual conditions these techniques must be adapted.

The reflected light method is where the meter is pointed directly at the subject to measure the light reflected from it. The simplest way to use reflected light readings is to use the averaging method (see page 34). But if the subject contains large dark areas, the exposure should be halved by using the A setting on the meter. In scenes with large expanses of light tone the exposure should be increased—the C setting is

Castle *Deliberate underexposure—here by one stop—often helps to ensure good colour saturation and is particularly useful in bright, harsh sunlight*

usually adequate.

For colour photography, the incident method is often preferable. This measures the light falling on the subject, and so is not affected by the tone of the subject. Under most circumstances this gives reasonable and realistic tone reproduction, especially with backlit subjects. But in subjects with plenty of specular highlights, such as the sun reflected off water, slightly less exposure is usually preferable in order to give some detail in the highlights. This is especially true with transparency film where burnt-out highlights rarely look good. Using the A setting in these conditions should improve results.

Incident light readings are usually taken using a diffuser dome over the meter cell. If your meter does not have one of these, you can take a reflected light reading from a standard 18 per cent grey card. Should you find yourself in the situation that you want to take an incident reading, but have neither a diffuser dome nor a grey card, then use a piece of white card or paper, using an ASA setting on the meter equal to the speed of the film divided by five.

Selective metering

The methods mentioned so far involve very general readings of the subject and light. But for more critical work it is better to take reflected light readings from specific parts of the subject.

The simplest of these methods—the brightness range technique—involves taking a close-up reading from the brightest part of the subject, and a similar reading from the darkest part, making notes of the exposure values each time. The main exposure index (the main arrow) is then placed half way between the two readings. This ensures that the brightness range of the subject falls in the right place on the characteristic curve of the film (see page 2346), so that there is no unnecessary loss of detail in shadows or highlights.

The film latitude is shown by the U and O marks—a range of seven stops. This is intended primarily for black and white work, so for use with colour transparency the range should be reduced to five stops by using the next set of marks.

Sometimes the brightness range in the subject may be too great, in which case you will have to sacrifice some detail—either in the shadows or the highlights. If the highlight detail is most important, then take a reading from the brightest diffuse tone and set the O position opposite the given reading. If shadow detail is more important, then use a similar procedure, metering from the darkest tone and using the U setting. The U setting can also be used with films (usually black and white) which have a long tonal range. This is an alternative to the previously mentioned brightness range method. With long tonal range films, the highlight detail is not sacrificed, but metering from the darkest tone and using U gives good shadow detail in the final picture.

Another reflected light technique is the key tone method. This is where you meter from an area which you want to appear as a mid tone in the final picture. If, for example, you want a skin tone to appear as a mid grey, you simply meter from the skin and use the main index on the meter dial. Variations are also possible using the other marks. You might decide that skin tones look better if they are one stop lighter than mid grey, in which case you could use the C mark.

Settings on the Weston meter

WESTON *Euro*-MASTER

1   'U' position permits exposure determination by measurement of darkest object.

2   Provides quick means to decrease exposure by three f/stops.

3   Provides quick means to decrease exposure by two f/stops.

4   'A' position provides a means of giving half exposure.

5   'C' position provides a means of giving double exposure.

6   Provides quick means to increase exposure by two f/stops.

7   'O' position permits exposure determination by measurement of lightest object.

U & O Using the U setting in the darkest area gives the best shadow detail, while metering from the lightest tones with the O setting concentrates on highlights

John de Visser
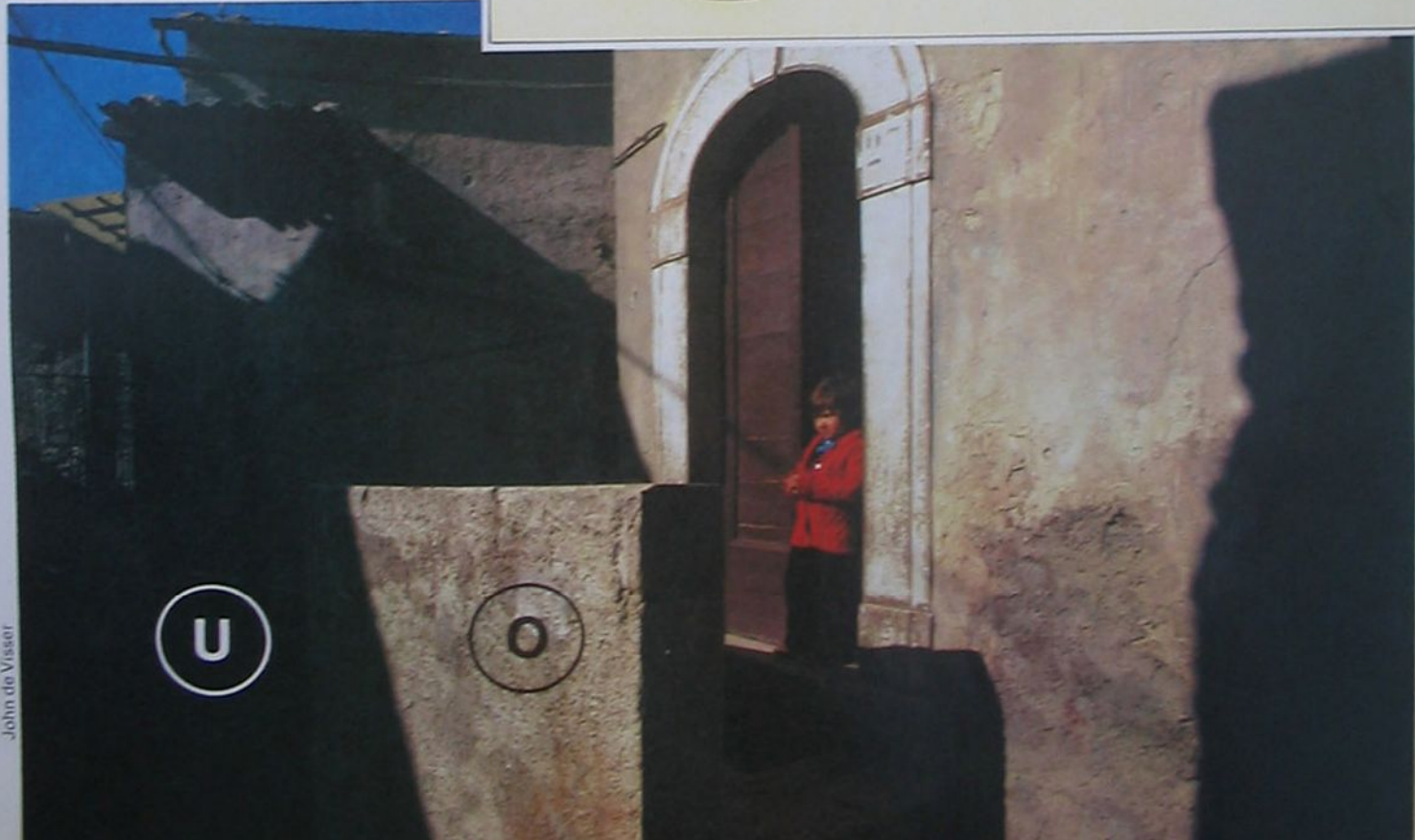
Custom cameras

If your demands on equipment are very specialized and nothing on the market is quite right—or if you simply want to give your camera the personal touch—'customizing' may be the answer

For most photographic purposes, the equipment you can buy off-the-shelf is perfectly adequate. But this does not mean that it cannot be improved upon or adapted to suit your own special needs. Customizing—the modification of equipment to suit specific customer needs— can make your equipment far more usable, or versatile, more comfortable to use or just more attractive and distinctive.

The range of modifications is enormous. Some customizations are designed to make equipment suit par-

Red coat *To cater for the growing demand for personalized cameras and bright 'high tech' colours, some manufacturers produce their own custom finishes. This camera and matching tripod is the Konishiroku C35 EF3 in one of their range of fashion colours*

ticular style of photography. Others are designed to make the camera 'fit' the individual photographer better. At the simplest level, you can use black tape to mask out brightwork, or make focusing marks on the lens barrel with a wax crayon. At the other end of the scale, you can have the lens mount completely rebuilt to take a lens designed for a different format or even for a lens not designed for photographic purposes at all.

Alternatively, you can customize your equipment not to make it more usable but simply to make it more attractive or to give it a personal touch. You could give a chrome finished camera the popular all-black look, for instance. Or you could simply paint your own markings to make it instantly identifiable.

Some modifications are very easy to carry out and may be inexpensive. Others may require extensive work and cost more than the equipment cost new. The ease and cost of the modification does not necessarily reflect the usefulness of the change. A point to bear in mind is that extensive modifications may reduce the resale value. So before you make any changes, it is important to establish if they really will improve the camera.

Simple modifications

The simplest way to modify your equipment is to use some of the range of accessories or replacement parts available commercially. This is known as *system customizing*.

System customizing is particularly suitable with high-quality modular cameras, such as the Hasselblad, and many top-of-the-range models of the big systems SLR manufacturers. These cameras can be fitted with a wide range of focusing screens, viewfinders, grips and other optional components. You can make a selection by reading through the manufacturer's catalogue, and then

Colin Glanfield/camera courtesy of Roger Hicks

Superwide *An old 120 roll film camera was adapted to take a 65 mm Schneider lens to give a superwide picture*

visiting a camera store that stocks the full range of optional components. Some manufacturers provide more than 30 focusing screens for a single model, but you should check that these can be fitted by a user—screens for the Canon A-1 and Minolta XD-7 cannot.

Customizing with accessories is closely related to the systems approach. A typical example is the soft release or extension button. If you have large hands, you may find that these make your

Superfast *It may be worth adapting the camera to take a lens designed for an entirely different purpose. Here an f/1.9 Dallmeyer TV camera lens provided a superfast lens for a 6 × 6 cm camera*

particular camera much easier to use, but not if you have small hands.

Other examples include rubber eye-caps and wide camera straps (although many photographers prefer a narrow leather strap with a wider suede pad). And for cameras without a holder for film box ends, you can buy stick-on types, which work just as well. The possibilities are limited mostly by your personal taste. Some people like attachments for securing the lens cap to the camera; others find them extremely irritating.

Many people 'customize' their cameras simply by applying black adhesive tape to mask out brightwork on cameras. Even on all-black cameras, there are typically bright, white logos. These are often a nuisance in reportage photography, because they make the camera conspicuous, and in copying, when they reflect infuriatingly from

Leica Zeiss? *For some lens–body combinations, special adapters, such as this Leica–Zeiss are a simple solution*

glass. Plastic insulating tape has the additional advantage that it protects the bodywork from scrapes and knocks, and preserves its resale value.

Other ways in which the photographer can modify the camera to suit his particular needs include sticking high-friction rubber to selected parts of the camera to improve grip, making a thumb-pad from silicone rubber bath-sealant for a wind-on, using tape to seal an interchangeable prism against dust,

Superwide 3 *Although it may mean some sacrifices—the rangefinder coupling was lost here, for instance—a custom combination may meet special needs more nearly than any camera on the market*

Colin Glanfield

Colin Glanfield

David Rayment Kirby

suppliers can supply thin skiver or bookbinders' leather in various colours and patterns, including snake and lizard skin. Grippy plastics are harder to obtain, and are usually found by contacting plastics suppliers.

The body should only be repainted when absolutely necessary, since it involves removing the panels, which requires a great deal of skill. Once the panels have been removed they have to be abraded lightly with a metal abrasive, spray-painted with black enamel and then oven-baked to give a hard finish.

You should not attempt to paint over a chromed camera body as the paint will soon begin to chip and peel. Chromium plate must be stripped electrolytically, then primed and painted. Alternatively you could have the camera replated. Gold plating is not as expensive as you might think. But it will not give you a very hard-wearing finish and the results may be disappointing unless you can find a careful and understanding plater. Replating is usually only carried out on extensively modified cameras to give them a new appearance or (more rarely) when a camera is built from scratch.

Although you can do quite extensive modifications to the exterior of the camera yourself, you should never attempt to tamper with the mechanisms. In particular, it is important not to unscrew components. Even if you are an engineer by trade, all but the simplest modifications can easily upset the lens–film alignment, shutter accuracy, or metering. However well the work is done, and no matter by whom, this sort of work almost invariably lowers the value of the equipment.

There are a few exceptions, such as modified lens mounts to allow one top-class maker's lenses to be used on another top class maker's cameras. Leitz lenses on Nikons are a popular swap. Even then, the lens may prove hard to sell, and will certainly not recoup both the cost of the lens and modification.

Resale value is of little importance to professionals, who tend to keep one top-flight system. But for the amateur who wants to change his camera every few years it is more of a problem. However, when you have old equipment that is otherwise unusable, it may be worth doing extensive work. It may also be worthwhile if the ideal combination for your type of work involves incompatible items of equipment.

Lens mount

The most difficult and expensive customizing operations are those that change either the mount on the lens or

and cutting pieces of gelatine filter to fit in a rangefinder window to increase the contrast of the split-image.

Body changes

Customizing need not necessarily be limited to minor modifications. Even major tasks you may be able to do yourself. For example, stripping off the artificial leather covering on a camera to replace it with real leather or with high-grip rubber is not difficult if you are

reasonably competent. You are unlikely to do much damage, but a poorly executed job will look bad and may not even provide a good grip.

The ease of customizing the body finish depends on the particular camera. To replace the covering, the old one is stripped carefully, taking pains not to stretch it, and used as a pattern for the new cover. If the old covering is distorted, a pattern is made up by trial-and-error using paper. Specialist leather

'Polacheck' *A Polaroid customized for exposure checks, with an 80 mm f/2.9 lens and a full range of shutter speeds*

Canon F1 *Many larger format lenses can be adapted to fit 35 mm cameras, as with this Hasselblad 1000 F 80 mm lens on a Canon body*

the mount on the camera body.

The use of an adapter is a worthwhile alternative to customizing, because it is usually cheaper and does not require alterations to the camera or the lens. Many adapters are available from stock, and there are a few firms that specialize in making one-off adapters. One useful example is a Nikon-to-Pen F adapter, which allows the excellent Micro Nikkor to be used for microfilming on the half-frame Pen F.

However, for many lens–body combinations—particularly with specialist lenses—there is no suitable adapter and the camera must be modified to take the lens. Unfortunately you are likely to lose some or all of the camera–lens linkages, although a skilled repairer will usually be able to retain the automatic diaphragm (albeit expensively). So the best cameras for this approach are usually the simplest. For example, you can modify almost anything for use on a Leitz Visoflex housing, because there are no linkages to be disrupted by any customizing work.

For lens changes, the favourite are the relatively simple long focus lenses of 200 mm and upwards. On lenses longer than 500 mm, customizing is almost common, because the lenses available tend to be highly specialized. For the highest contrast—most important in ultra-long lenses—the two-glass Leitz Telyts are best, whereas if you want a 1000 mm mirror lens with an aperture of f/5.6, the Zeiss Mirotar is a likely choice. The Leitz Telyts have preset diaphragms and no metering, and the Mirotar is a fixed aperture lens.

If you want to use a wide range of lenses from a different maker, it may occasionally be worthwhile to have the camera mount customized instead. Many people have Exas and Exaktas converted to the M42 mount, but this removes the possibility of diaphragm automation. One photographer had an old Canon Pellix converted to a Nikon mount, so it would fit in with the rest of his Nikon system whilst retaining the (slightly dubious) advantages of the fixed pellicle mirror—this was a thin, half-silvered mirror that stayed in place when the picture was taken, a feature later incorporated in the Nikon F2H.

The ease of conversion depends on the original film-to-flange distance of the camera. The 43.5 mm of the Nikon, for example, means that there is very little scope for modifying the camera body (and it is hard to see why anyone would wish to). But the lenses can be adapted to fit many cameras. Conversely, the slim-bodied Alpa and Olympus Pen F reflexes can be used with almost any lens—there is so much room to spare that an adapter is all that is needed.

Specialist customizers

If no modification of an existing camera will give you quite the facilities you want, you may be able to have a camera built up for you from specified parts. A good example of a custom-made camera using many existing parts is the Glanfield Super-Wide. The body was part of an Ensign Selfix 820 folder; the lens is a stock Schneider 47 mm Super Angulon in a Compur shutter and Schneider focusing mount; the finder comes from a rangefinder Canon's 19 mm lens.

Another ingenious camera, also from Glanfield, is the Pola-Check, which is basically a simple Polaroid camera body with a front-cell focusing lens (from a rollfilm folder) and a shutter on the front. It extends Polaroid checking to those whose cameras cannot take Polaroid backs.

In New York, Marty Forscher is famed for his custom modifications, including the use of fibre-optic faceplates to give 35 mm users the possibility of using 24 × 36 mm Polaroids. In the absence of interchangeable backs for 35 mm cameras, this may call for additional modification to be useful.

Leica *Reputedly built for a Maharajah, this gold plated, lizard skin covered Leica Luxus was followed by a further 95 'custom' built variations*
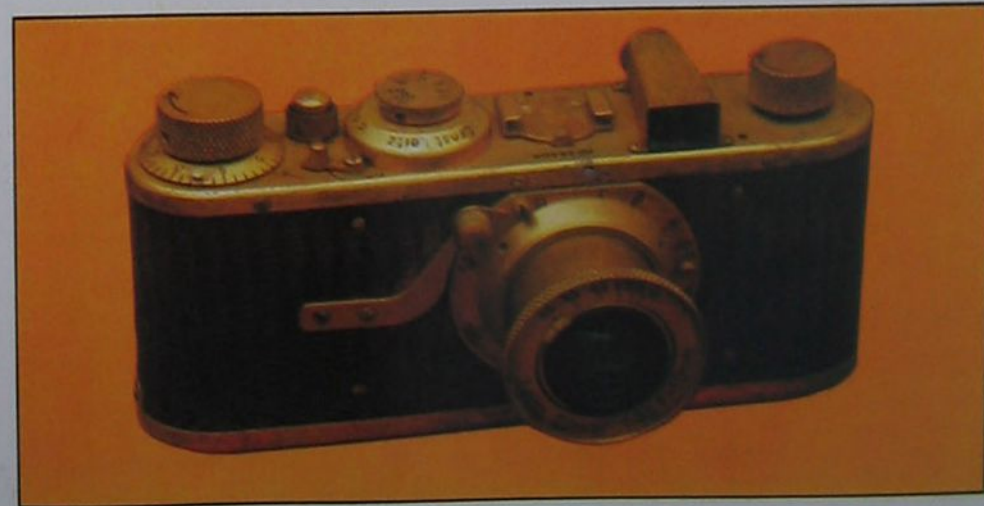
Putting your pictures to work

Photography can be an expensive hobby, even if you do your own processing, so why not try putting your photographs to work and make them pay for themselves?

Brian Hill

Christmas card made by silkscreening a lith version of an original photo and adding lettering
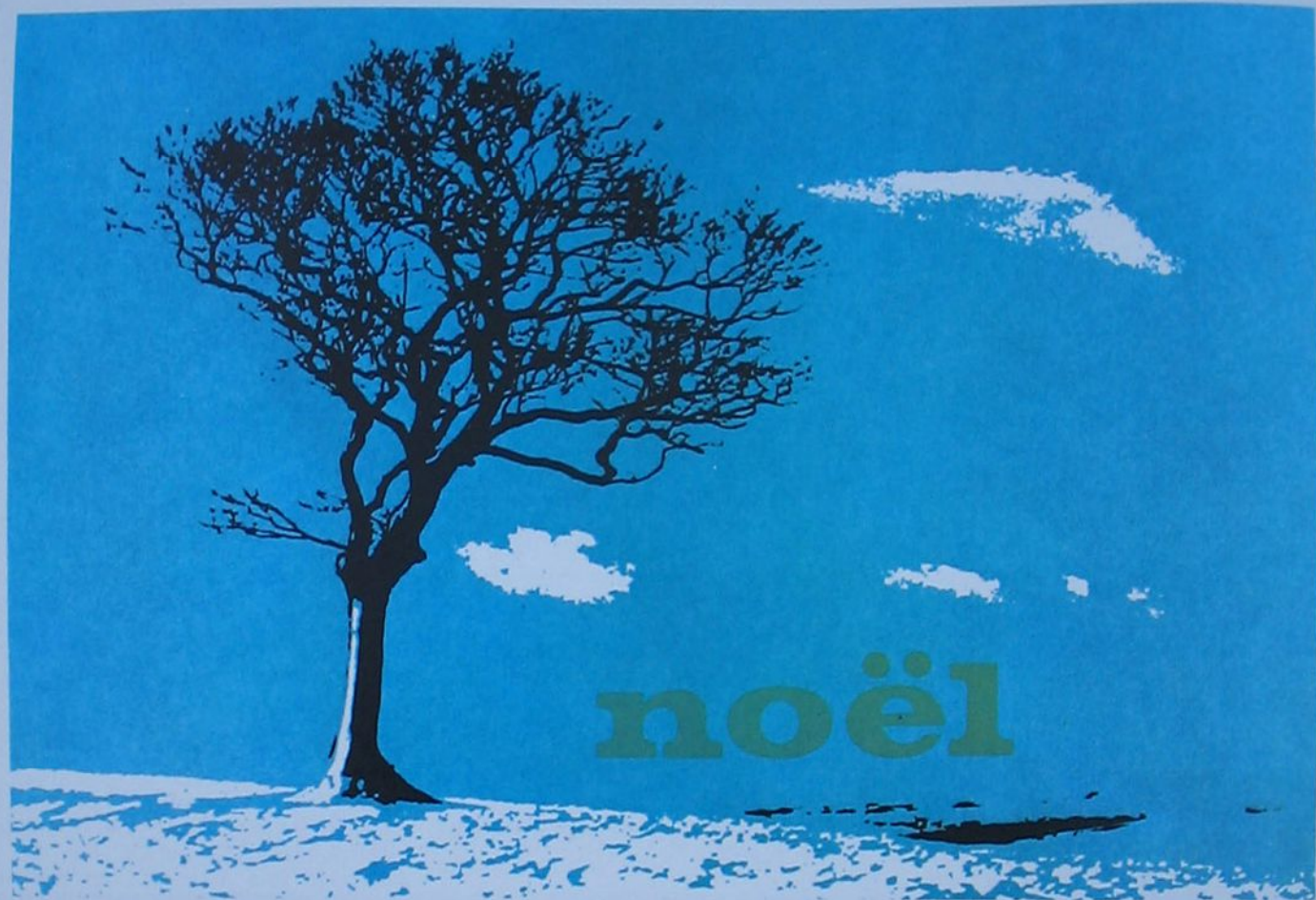
After taking and processing them, many amateur photographers leave their pictures lying in a drawer. This seems a terrible waste, when there are many ways in which you can make your photos work for you—from adding a personal touch to household items, making greetings cards and novelty items, to actually selling them.

Greetings cards

Greetings cards are naturally a popular way of using photographs. The simplest way to make them is, perhaps, to produce prints in the darkroom and stick them to a stout card. For small numbers of cards, this is cheap, and the pictures can naturally be of high quality. But it is difficult to make the photos stick neatly: they tend to lift up at the edges. The natural curl of the photo can make the card curl as well. Another disadvantage is that the inside of the card is not printed, unless you stick your photo over an existing card's design—though at Christmas photographic firms do often provide cards with slits to hold standard postcard-sized prints.

If you do stick photos on cards, use a rubber-based adhesive sold in tubes or cans. The tubes are better than the cans since they do not dry out so easily, though they are not so widely available. Aerosol mounting spray is now considered something of a health hazard and is banned by many professional layout studios.

Spread adhesive on both surfaces, overlapping the area of card to be covered. When it is fairly dry, press the photo on to the card. Then, with an eraser made of dried adhesive, remove the excess from around the photo.

For a more professional look, you can use dry mounting techniques (see pages 740 to 743). It is particularly worth dry mounting if you want to print pictures or lettering on the inside of the card as well because, when dry mounting, you often have to mount a print on the inside anyway to counteract the curl of the cover print.

Separate prints for outside and inside can make the card rather bulky—especially when you consider the thickness of the card necessary to overcome the two prints' natural curl. The card can also be printed on both sides photographically if you coat it with liquid emulsion (see pages 1306 to 1309) but this does not generally provide adequate blacks. So the best alternative is to have the card printed by litho or instant print, using *camera ready copy* which you prepare in your darkroom

This process gives a printing quality which is inevitably poorer than your own top quality printing. Furthermore, full colour printing is very expensive, so you are restricted to monochrome. But it is a simple and effective way of making attractive cards fairly cheaply.

Rather than go for a halftone original which has to be dot screened (see page 2414), with an inevitable loss of quality when shot dot for dot, it is best to aim for a line original. This could be a line copy of a line print, such as an old engraving copied from a book, or one you have converted to line yourself (see pages 914 to 917). This requires a suitable scene which will work well in lith form—snow scenes are often ideal.

Use instant lettering for the inside text. Take great care over the evenness of the lines. Use light blue pencil to mark in your guidelines since this will not show up on ortho copy film but will appear white on pan film. You can buy 'non-reproducing' pencils from graphic art suppliers but any light blue pencil will do. Another mistake that people make is to space the letters too widely. Often only the tiniest of gaps is needed, and anything more looks odd.

If you have only one size of lettering, you can lay down the letters, make a lith negative and then enlarge each line to the size you want. Even if you only have a 35 mm enlarger you can make a copy negative on lith of sufficient quality by putting the original on the baseboard and illuminating it (see page 1122).

To preserve quality you may prefer to make your camera ready copy half up and let the printer do the sizing; but many instant print shops are rather more expensive if you want anything other than same-size (called s/s in the trade) copies.

Rather than have both sides printed, you can design your card around an A4 sheet folded twice. Then the firm need only print one side, and on heavy paper rather than card. You can, of course, print the card in the same way yourself. Either way, you should fold up a dummy sheet first so you know which way round to lay out your camera ready copy. Mark the surfaces of the dummies very lightly with a pencil so that you know precisely where to lay the print.

Once you have decided on the principle of, say, a Christmas card, you can try to take a photo specially for it—a snow scene, for example, or even simply a picture of all your family. Visualize how it will look on the final card, bearing in mind high contrast effects.

Bear in mind that instant print is unsuited to handling large areas of black or halftones, so restrict the image to lines and areas of black in the range of about 0.3 mm to 10 mm if possible. But remember that you can ask for the image to be printed in any coloured ink instead of black, on coloured paper. You should also discuss your requirements with the print shop first—they may have a restricted range of card thickness and ink colours and have to order.

Making a greetings card

1 For a limited number of cards, you can use ordinary black and white or colour printing methods. First choose and prepare the image components
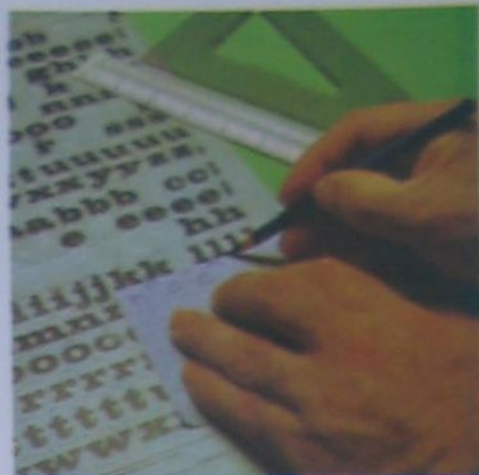
2 Dry transfers are ideal for lettering. Once you have chosen the type, work out how much space you need for your caption from the sizes given on the transfer sheet

3 If you are copying on ortho film, you can mark the original itself with a blue pencil (which will not show up on ortho) to show positions for the lettering
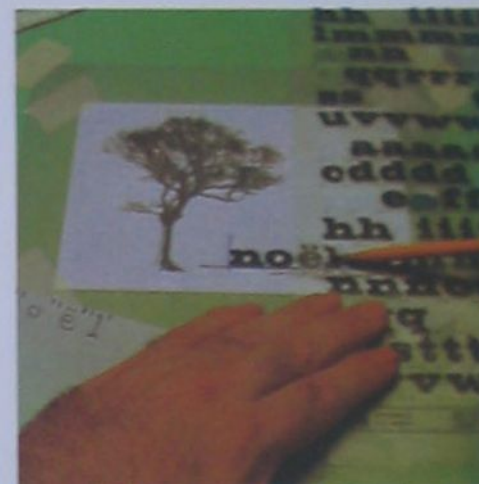
4 Lay a sheet of suitable acetate (such as Kodatrace) over the print and carefully burnish each letter into position. Rub gently to avoid cracking the letters

5 When each letter is in position, very carefully peel back the transfer sheet. If a letter breaks, let the sheet fall back into position and then burnish again

6 You can now copy the original plus the lettered overlay quite easily on ortho film with your enlarger using standard copying techniques

Tim Stephens

2485

7 An alternative is to add the dry transfer lettering to one of the lith image components. Here it is shown on the film used to print black in the card
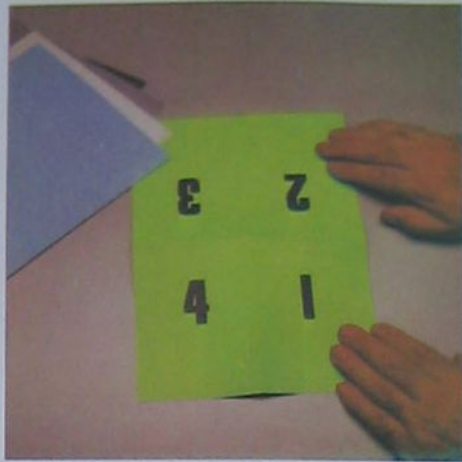
8 To print 'both sides', you can print all the images on a large sheet and then fold. But you must work out the folding first to establish how to print the images
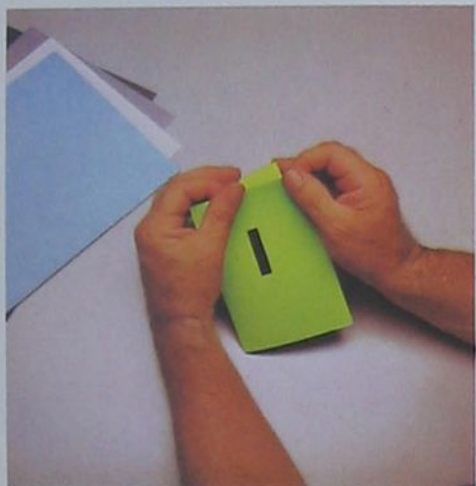
9 Folding can be done easily enough by hand, using the flat of a finger- or thumbnail to form the creases. For a neater edge on thick card, score along the fold first
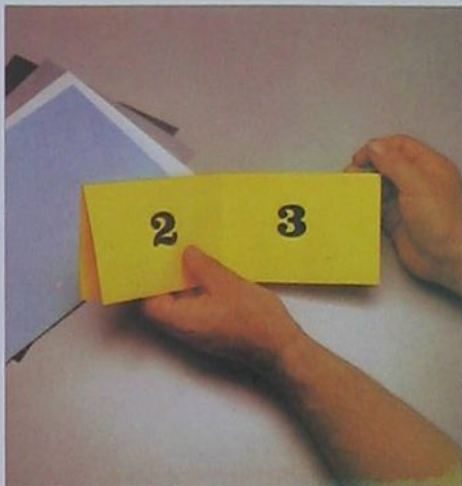
10 Folding 'dry runs' and dummies can help you correctly locate and properly orientate printing or lettering on all outer facing surfaces (shown here in figures)

11 Try various folding techniques to ring the changes—this 'concertina' form looks good and stands up much better than conventional foldings
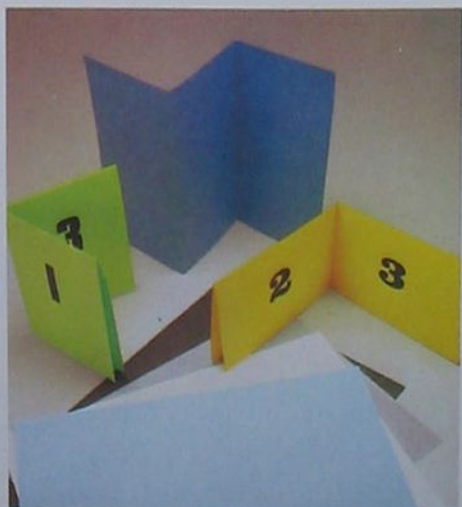
12 Other changes can be made simply by changing the size, area, colour and format of the paper or card used for mounting or printing your greetings cards

Tim Stephens

Selling images

While even amateur artists often sell paintings, amateur photographers rarely sell prints, especially artistic ones.

But professional photographers do sell prints, often at quite high prices. The minimum price they would put on a black and white print, without frame, is about the same as that of three rolls of Kodachrome; as for the maximum, the sky is the limit. But you have to have considerable artistic talent, taking more than just pretty pictures, to get into this highly competitive market. You need an understanding of what sells and what is likely to be accepted by a gallery for the necessary exposure.

If you consider yourself the type of photographer who is likely to produce modern classics, have a word with your local photographic gallery to see how they like photos prepared. Prints should be made in limited editions—never less than 30 and not more than 75. Each handmade print will be unique—and no reputable photographer goes back to a negative again for further prints. At the moment, the market seems to be becoming interested in specialized print processes—such as platinum prints (see page 2360). Prints should be 10 × 8 inch, signed and dated—and you should mark on the number of prints you made from the negative that day. They should be either unmounted or mounted on acid free archival mounts (see page 741). And for display purposes it is best to frame them properly.

Nevertheless, you can sell pictures in a much less high-powered way. There could be a market for local views and attractive scenes in your neighbourhood. You could display them alongside paintings in a local outdoor market. Other possible outlets are craft shops and even local newsagents.

The Americans are showing the way in this field. It is not uncommon in places like San Francisco to be able to buy prints from stalls in tourist areas such as Fisherman's Wharf—but you may need a street traders' licence if you too set up a stall in your area. In New York, some people just sell their prints on the street, and there are probably many more potential markets. Many people would be happy to buy an A4-size print—even in black and white—of some attractive local scene, framed, for the price of a holiday films as long as it was well taken. This would allow both you and a retailer a reasonable profit margin.

Choose scenes that offer real photographic potential—use your photographer's eye. If you hope to attract people with your shots, it is worth taking trouble over them. Even if your area is not particularly full of attractive old buildings, you can still use your skill to create good pictures with strong local interest. Discuss with friends what they think people would like—do your own market research.

Make prints with care, especially when fixing and washing. Customers will not be happy with prints that turn yellow

your local photographer would not consider worth tackling. These include small, individual jobs such as photographing the interiors of people's homes, or even such mundane things as flower arrangements, vehicles or back-yards before a conversion is done—you could offer a before and after service. Try to create a market by offering suggestions. You could advertise your services simply by putting a leaflet through neighbours' doors.

But remember that these days practically everyone has a camera. So stress your advantages. You have photographic skill, more lenses and filters, better lighting facilities, the ability to make big prints and, hopefully, your creative eye.

Some people actually photograph people's houses as a sideline. To do this, use a 6 × 6 cm camera to take every house in a street. Use techniques like polarizing filters or graduated filters to add interest to the sky. Maybe even take the photographs from the roof of a van to give an unusual viewpoint over any hedges or fences. Then supply each householder with a free contact print and call round later to take orders. Your costs for each b & w contact print can be very low indeed—probably the greatest expense is driving the short distance to the street. As long as an average of, say, one householder orders a print a film you can make a profit. Your main consideration is whether it is worth your time and effort to do it.

But if you are entertaining the idea of entering the commercial world of photography remember that you must be able to offer quality, reliability and permanence. After all, as a local you are even more vulnerable to complaints and word-of-mouth criticism than a firm. But then, recommendations can get around just as quickly and you could find yourself in demand.

after six months. In tourist areas put yourself in the place of a tourist and look at postcards. There is no point in duplicating those shots, particularly as they tend to be unimaginative. You can produce your own postcards from prints, though for the printing on the back—details of the pictures, the line down the middle and the address rules which people expect—you would have to consult a local printer about handling a batch. Check the prices, and do a costing which will allow retailers a good profit margin—at least 30 per cent.

Other ways of using your darkroom skills to make saleable items are discussed in the articles on liquid emulsion (see pages 1306 to 1309), special materials such as photo linen and aluminium (see pages 1026 to 1029) and photo-etching (see pages 2365 to 2369). Look at existing commercial lines and try to improve on them with scenes of local interest. Other interesting possibilities are offered by the etch–bleach process (see pages 2122 to 2125) and Color-Key (see pages 2628 to 2532) for making graphic prints quickly and cheaply.

Working as a photographer

Some amateurs set themselves up as part time portrait or wedding photographers, but this is entering into direct competition with local commercial photographers who might regard your efforts as unfair competition, especially if you undercut them. After all you have no overheads and only want pin money.

There is nothing to stop you doing this, of course, but it is somewhat unethical. What you can do, however, is work that

Photos at work *Just some of the many ways in which you can make your photos work for you. Personalized greeting cards are always popular; mounted prints of the family are good presents for distant relatives; photo key fobs and bookends make nice individual gifts; and etch prints of your own photos can add a touch of class to your walls. If your pictures are of a consistently high standard, you may be able to display them in a local gallery or sell off prints in limited editions through a suitable outlet such as an art shop*

John Beveridge/courtesy of The Photographers' Gallery

DENIS WAUGH

Discovering a secondhand Gandolfi was the turning point in a career which would eventually bring Denis Waugh's distinctive style to top magazines in the UK and USA

Every top photographer has his own personal style, but few are so instantly recognizable as Denis Waugh's. The rich, saturated colours, the warm tones and the soft, finely detailed image are usually unmistakable, whether the subject is a veteran car or dawn over Halifax. Waugh's atmospheric shots of the British landscape are particularly distinctive. And everywhere they appear—as they do frequently in the British *Sunday Times* magazine—his pictures add a touch of class.

Nowadays, Waugh's carefully composed photographs seem to have been part of the British magazine world for years. It is surprising to learn that it was not until the late 1970s that he began to earn his reputation through the pages of these magazines.

Although he was born and brought up in New Zealand, Waugh's career as a professional photographer did not begin until he came to Britain in the late 1960s.

Waugh's start in photography could almost be said to be accidental. By a stroke of bad luck he caught tuberculosis shortly after coming to Britain and was confined to a hospital bed for some months. A chance reading of the old-established *British Journal of Photography* brought to his notice a new course that was being started at London's Royal College of Art.

'I thought it sounded quite interesting and because I had come from a different culture I wasn't put off by the college's status. I didn't even know it was so difficult to get into'. As a result Waugh applied and, to his surprise, was accepted as one of the RCA's first photography students. Although the course suffered the inevitable drawbacks of any course breaking new ground, Waugh feels that it was crucial to his career. Above all, it gave him a feeling of self-confidence in his photography and 'the most practical and useful sense of direction I've ever had in my life.'

Besides giving him the chance to experiment with new equipment and facilities, the course also gave Waugh access to a wide range of professional

Portrait *This portrait of Thomas Eyston, with its immaculate lighting and composition, typifies Waugh's approach. He mixed daylight and flash, exposing for five seconds*

Clevedon pier *Waugh took this shot as part of a series on 'Piers in peril' for the Sunday Times. He used a ½ second exposure to soften the wave and warmed the tones with red and 81a filters*

Waiheke Island *When Waugh returned to his native New Zealand he took his Ganfolfi and the muted and restrained style gained in the English countryside*

photographers. Waugh remembers in particular Lester Bookbinder, a visiting lecturer, who was already a well-established advertising photographer. 'I was amazed at his professionalism. He is a completely motivated photographer and he was like a surgeon to watch—so precise in his attention to detail and his concentration.'

Waugh emerged from his course in 1971, 29 years old and full of enthusiasm. 'Like all ex-students, I felt there was a great big wonderful world out there waiting to give me work'. Reality was not quite as wonderful, but slowly Waugh began to do a few commercial jobs. They included book jackets for Fontana and Penguin, a series of record covers and work for various trade journals including *Engineering Today*. Nevertheless, he remembers that in his first year he earned very little and that his wife was working to support them both.

Although Waugh spent the next seven years earning a respectable living as a working photographer, he pinpoints his real breakthrough precisely—to the first work he did for the British *Sunday Times* colour magazine. Waugh owes this crucial break to a change in direction he had made several years earlier. This change had been made mainly in his personal photography and it dated from the time he acquired a hand-made Gandolfi plate camera secondhand for a comparatively low price.

'I'd seen someone else's and I thought it looked fun. It was such a beautiful looking thing—all mahogany and brass and more like a piece of furniture than a camera. And it took the kind of photographs I liked. All I could afford with it was one lens, a 90 mm Super Angulon which was a wide angle on 5 × 4 format.'

Up until that time all Waugh's commercial photographs had been taken on a Nikon or a Hasselblad, depending on the type of assignment he was doing. But now, whenever he was off on assignment, he also packed his Gandolfi and he began taking superb landscapes.

The success of his landscape photography was closely linked to a growing love of the British countryside. 'Coming from a country which is a land of great visual contrast—rich, vertical and full of oversaturated colours—I initially thought that the British landscape was boring. Here the landscape is very horizontal and flat. It's a gentle, water colour, mist filtered landscape whose subtlety I only slowly began to appreciate.' His new appreciation of the British landscape was to be the start of what he calls a 'long lingering love affair' with it and his Gandolfi was his chosen way of expressing his relationship with the countryside.

By the time Waugh was given his first commission from the *Sunday Times*, he had already made two previous attempts to get work from them. Each time he had been disappointed. Then in 1978 he tried a completely new approach. Jettisoning his commercial portfolio, Waugh went in to see the *Sunday Times* magazine's picture editor, Bruce Bernard, with a handful of his large format transparencies. They were mainly landscapes supplemented by a few portraits that he had taken for the cover of *Engineering Today* and *Marketing*.

This time the end result was very different and he received an immediate assignment. Waugh's first jobs for the *Sunday Times* were for scientific features. But although they were technically difficult, he was determined

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to do them well, and happily the
magazine was pleased with the results.
Waugh used both his Gandolfi and his 35
mm equipment on these early assign-
ments, but began to use his Gandolfi
alone more and more. Although satisfied
with his 35 mm work, he felt that it was
only his large format work that he really
wanted to do. 'The 5 × 4 was impressive
in so many ways. If you get the pictures
looking good, they seem ten times better
than they would on 35 mm.'

Waugh attributes his spectacular
success largely to this change of
approach. He also feels that he owes a
tremendous debt to Bruce Bernard for
his development as a photographer. 'I
owe more in my photographics life to
Bruce Bernard than to any other person
and I think a lot of other photographers
feel the same. He's an incredibly honest
man and very intuitive. He knows what
makes a good picture and the sort of
photographers who will take those
pictures. Also he wouldn't categorize
me—he'd throw the most unlikely jobs at
me so that I would always feel stretched,
and that helped me a lot.'

Bernard would often get his photo-
graphers to go on assignments that were
totally new to them and Waugh did
everything from group portraits to food
shots for him, although his main subject
matter was the landscape. By November
1979, when the Times suddenly went off
the streets for almost a year, Waugh was
working almost exclusively for the
Sunday Times. The Times' sudden halt
was thus a terrible shock and Waugh
realized that he would have to move fast
to get some other sources of income.
Since then he has worked for a variety of
magazines, including the Observer
colour magazine, and lately the Express
colour magazine and tries not to rely too
much on any one source of work.

One of the marks of Waugh's recent
success has been work from the
prestigious American magazine, Life.
Waugh's first contact with Life had been
when they published a personal picture
of his taken during the Queen's Jubilee
over a double page spread. A short time
later they phoned him to do an assign-
ment. They had a particularly strange
story about a dog that climbed trees.
'They wanted to use it as their joke
picture of the month. It poured with rain,
the photography was mundane and the
subject was silly. I was terribly
embarassed by the whole thing but they
loved it so they remembered my name.'

After doing another small job for Life,
Waugh heard nothing more from them
until 1981. He had gone to New Zealand
with his family for a major nine week
trip—travelling around, visiting his
family and, of course, taking photo-
graphs. Then, suddenly, a couple of days
before his return, the London office of
Life rang to say that they had been

Portrait A long exposure (¾ second at
f/16) was used to soften the water and
foliage in this portrait of writer and
artist Kit Williams

Denis Waugh

Toledo *This pastel-toned photograph of the hill town in Spain was shot for a story about El Greco, the Spanish artist, on commission from the American magazine 'Life'*

Royal Portrait *This portrait of Queen Sofia and Crown Prince Felipe of Spain is from a series on 'The Royal Heirs of Europe', published by 'Life' in August 1982*

looking for him all over the world. He was commissioned to photograph a major story on the *World of Prince Charles* to coincide with the Royal Wedding. Waugh jetted back to London and was working within 24 hours. Fortunately the effort was justified, for *Life* used many of Waugh's pictures in an extensive feature.

The Royal Wedding also gave Waugh another of his favourite photographs—an extraordinary night shot of the fireworks in Hyde Park for the *Sunday Times*. He says that anyone could have taken it. 'It was perfectly simple. I was perched on top of the Hilton Hotel with about a dozen other photographers, all using 35 mm. I used daylight film with no filtration. Then I just followed the manual: a 30 second exposure, open shutter, close shutter, and that's it.'

Nowadays Waugh uses his Gandolfi camera almost exclusively. Apart from his original 90 mm lens, he now has 150 mm, 210 mm and 300 mm lens, but still does most of his work with the wide-angle. He also uses a wide variety of filters in most of his work using Kodak gelatin filters in Chromafilter holders. Out of this set of about 25 various filters he most often uses various combinations of a basic set of eight. This will usually consist of several of the 81 series of

warming filters, two or three graduated neutral density filters, a couple of special frost filters and a couple of red filters—which counteract the tendency to green produced by the reciprocity effect of long exposures.

Waugh gets his frost filters from a firm that specializes in filters for film cameramen. They have a much subtler, softening effect than the soft focus filters normally available for still cameras. Waugh rarely takes a picture without using at least one of these filters, and may use a combination of up to seven filters on any one shot. He will also use warming filters on any flash units he uses.

Another factor that influences Waugh's individual style of photography is his use of long exposures. He cannot remember using a shutter speed faster than a 1/15 and is more likely to expose his subjects for anything from 30 seconds up to several minutes. Even his portraits are taken on exposures of five to ten seconds. If he is using flash this will serve

to balance the light and also helps to soften the overall effect.

On assignment, Waugh generally takes a minimum of 10 shots for every subject and his average is closer to 30. Each of his 5 × 4 film holders takes two plates, so for each shot he quickly flips the holder. He thus ends up with a series of shots, each with an almost identical duplicate. This means that he can process his duplicate series of shots after the first series. At this stage he can push the second series of shots to exactly the density each requires.

For Waugh, the way in which he works gives him far greater control over the way his work is seen. His photographs are rarely cropped and although his clients are usually presented with a small choice of final transparencies, each will be superb.

It is this dedication to perfecting his highly individual approach to a subject that has earned Waugh such a considerable reputation. His pictures, with their

almost formal composition and heavily saturated colours, portray his subjects with a luminosity rarely achieved by other photographers. The painterly quality of Waugh's work is also a reflection of his passionate interest in painting, especially in the works of the Flemish school and he is impressed more by painting than by photos.

The type of photography he prefers to do has generally been editorial. But lately he has returned once more to advertising work. With his new attitudes to photography he has found to his delight that advertising work can also give him considerable creative scope.

Advertisers, of course, generally have more money to spend on their photography than magazine picture editors and, although Waugh generally prefers editorial subjects, he enjoys the extra scope—and pressure—of advertising photography. Although as he comments, 'It can be a bit frightening. You feel you have to concentrate much more—you're

responsible for so much money.' He was also delighted when the art director of a recent advertising assignment chose a dense and difficult to print shot of a Cumbrian village at night. As the agency controlled their own plate-making the picture reproduced beautifully. Most magazines would never have been able to take such a risk.

Another recent departure for Waugh has been taking stills for film publicity. The British film producer, David Puttnam, saw a photo essay that Waugh made for the *Sunday Times* magazine about seaside piers. As a result, Puttnam asked Waugh to take photographs during the production of *Local Hero*—a film written and directed by the creator of *Gregory's Girl,* Bill Forsyth.

Puttnam chose Waugh for his ability to evoke the atmosphere of the film's subject matter. So successful were the results that Waugh may now do some photography for another film project. But this time his pictures will be incor-

porated in the film using front and back projection.

In spite of his evident enjoyment of these new departures, Waugh's conversation and his work inevitably return to his favourite preoccupation—photographing landscapes. One of his most enjoyable recent assignments has been for the American edition of *GEO* magazine, photographing the lyrical and romantic scenery of the English Lake District for a story about the Lake poets.

Waugh continues to adore the British landscape and the quality of light to be found there and part of this love, he feels, is a natural result of being a New Zealander. 'However long I work and stay in Britain, I will always see it as an outsider, which is a wonderful asset and a wonderful bonus.'

But the most important thing, Waugh feels, is that he enjoys his work. 'I cannot stop taking photographs, whether people want me to or not. I hope that most photographers feel the same way.'

Stereo images-2

The two pictures needed for a stereo pair can be taken on an ordinary camera, shifted sideways between exposures, but real stereo enthusiasts prefer to use special binocular cameras and stereo attachments

When Henry Collen, under the guidance of Sir Charles Wheatstone, took the first stereo photographs in the early 1840s, he did not have a special camera. He used an ordinary plate camera of the time and made a stereo pair simply by making an exposure, moving the camera sideways a specified distance and making a second exposure. There is nothing wrong with this sequential exposure technique. Indeed, it is still a popular way of taking stereo pictures today, popular because no special equipment is needed (see page 1470). But the scope and quality of stereo photography is considerably increased by special cameras and attachments that allow simultaneous exposures.

Sequential exposures have two big drawbacks for stereo work. First, they cannot be used for moving subjects—even the tiniest movement of the subject between shots destroys the stereo effect. Second, they are time consuming and call for painstaking care to ensure that the camera is moved correctly.

It would be possible to make simultaneous exposures simply by placing two cameras side by side and firing them together. But this is unsatisfactory for a number of reasons. Essentially, the problem lies in achieving two images that are identical in all but viewpoint. Minor differences — differences that might not normally be perceptible—can show up glaringly when the images of the pair are viewed together; the stereo effect is weakened at least.

With two cameras, for instance, the exposures can be slightly different—because either the speed of

Stereograph *This scene from the Holy Land is typical of many of the shots taken on stereo cameras in the 1800s*

the film in each camera or the shutter speeds vary slightly from the nominal rating. Similarly, the focal lengths of the lenses on each camera may be very slightly different, so that the two images can never be perfectly superimposed. Even two lenses of the same specified focal lengths from the same manufacturer can be sufficiently different to be unsatisfactory.

Over the years, the solutions to these problems have taken two principle forms: *binocular cameras* and stereographic *beamsplitters*. Binocular cameras are cameras designed specifically for stereo photographs. Beamsplitters are attachments that fit on to the front of a conventional mono camera to allow it to make

Stereo plate cameras, from a wet plate sliding box of 1858 (top) to the Richard Verascope of 1894 (bottom right)

simultaneous stereo exposures. There are alternatives, such as interchangeable stereo lenses, but these are less important.

Binocular cameras
The idea behind the binocular camera is to have a single body with two lenses set a little way apart, just like two eyes—hence the name. The exposures can thus be made on the same piece of film so that there are no problems with variations in film rating and processing. The lenses can be perfectly matched during manufacture. And the body can be constructed to ensure perfect alignment and consistent separation.

The first commercial binocular camera is credited to A. Quinet of Paris, who put his camera on the market in 1853. Over the next 30 years, many binocular cameras were produced. Indeed, they were almost as popular as conventional cameras. Stereo photography was, if you like, the television of the Victorians, and many
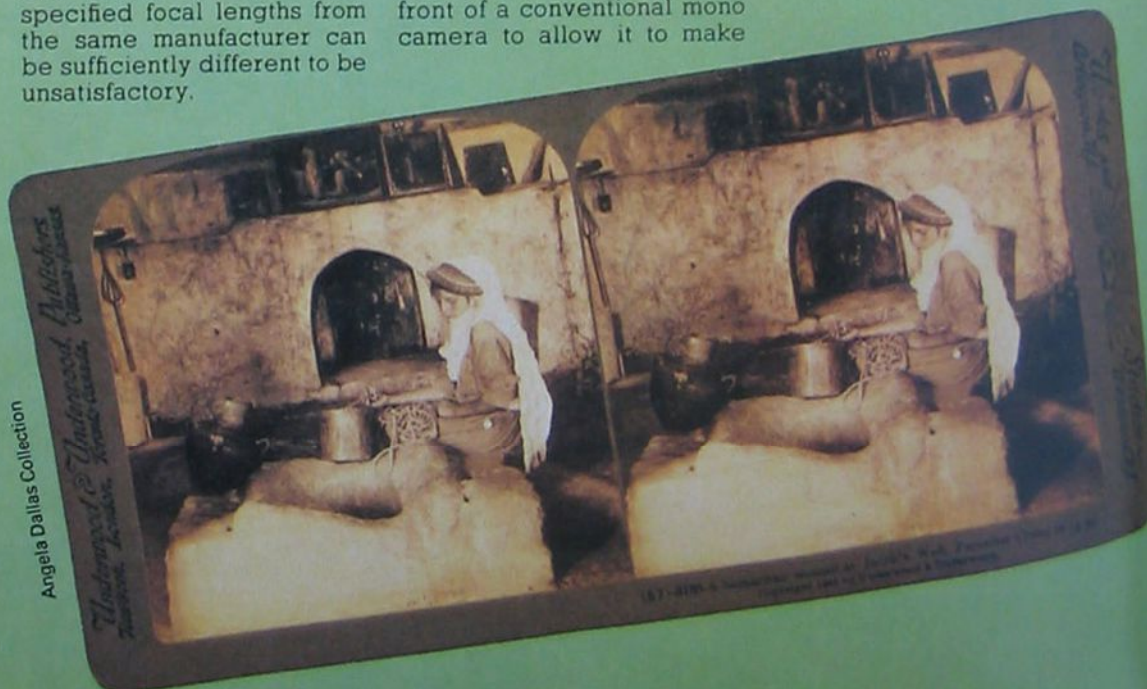
Recording stereo pairs on film

6 × 6 cm binocular camera
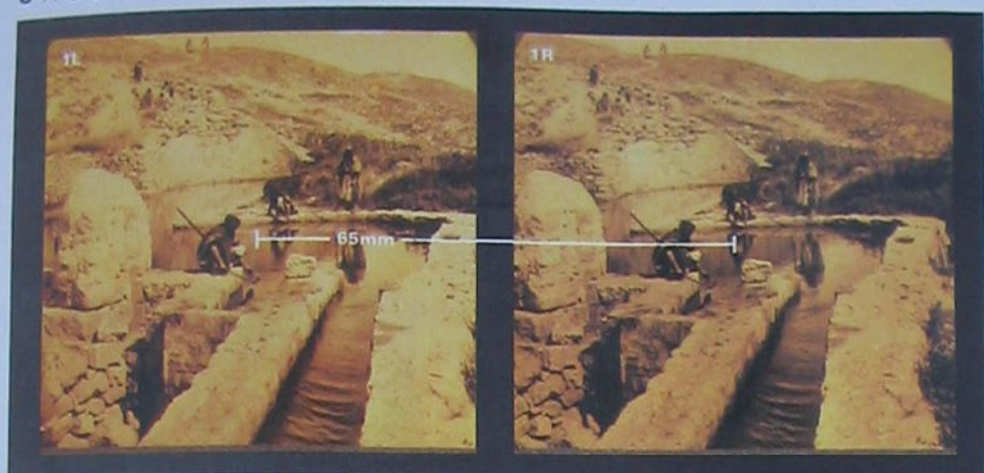
Artwork by Chris Lyon

65mm

35 mm binocular camera

David Parker

1L   2L   65mm   1R   2R   65mm

35 mm beamsplitter

Courtesy Pentax (UK) Ltd.

1R   1L

With the 6 × 6 cm format, the two images of a stereo pair are recorded side by side, with the centres separated by 65 mm. To achieve the same separation on 35 mm, frames have to be interlaced. With a beamsplitter, the attachment provides the separation and the pair are recorded in a single frame

intrepid photographers set out with their binocular cameras to bring back 3-D images of exotic places.

Many of these early binocular cameras were simple box-shaped plate cameras with two lenses set side by side in the front plate. But even in the 1800s there were some bizarre designs. A number of stereo cameras, for instance, looked like binoculars. In one, the photographer could appear to be looking through the binoculars in one direction while actually sneaking his stereo picture with the sideways pointing hidden camera arrangement.

Interest in stereo photographs declined towards the end of the 19th century, partly as photos in books and magazines created a more immediate form of information about how the world

looked. Binocular cameras continued to be produced, but they were much more 'novelty' items than they had been. Despite brief bursts of popularity in the 20s and 50s, stereo cameras never sold in quantity again.

Interestingly, manufacturers tended to choose the 35 mm format for binocular cameras from the mid 20s onwards, despite the fact that the 6 × 6 cm format is inherently more suitable. This is partly because of the novelty appeal of stereo cameras, but also because it is much easier to make fast matched lenses for 35 mm. With large format stereo cameras, maximum apertures are rarely wider than $f/6.3$. On the famous 35 mm Iloca Stereo Rapid of the 50s, however, you could get a Cassarit lens with a maximum aperture of $f/2.8$.

With the 6 × 6 format, it is relatively easy to work out the arrangement of stereo pairs on the film. Since, with a 5 mm gap between frames, the centres of two 6 × 6 cm frames placed side by side are exactly the required base distance (65 mm) apart (see page 2455), the film can be wound, two frames at a time, sideways behind the lenses just as in a conventional camera.

On 35 mm, however, recording the images on the same film from two lenses 65 mm apart is slightly harder. There are two principle solutions. The system popular in France gives negatives 24 × 30 mm. If the centres of a stereo pair of negatives like this are 65 mm apart, there is a gap of 35 mm between them. For the next exposure, the film is wound on one frame so that the right

half of the stereo pair fits into this gap and the lefthand image is recorded beyond the lefthand image of the first pair. For a third pair, however, the film must advance three frames, so that the righthand image is recorded on the film beyond the lefthand images of the first two pairs. This means that such cameras need a special film transport mechanism that advances the film by one frame and three frames alternately.

With the alternative system, giving 23 × 24 mm negatives, the film can be advanced simply two frames at a time. It is thus easier to make the transport mechanism, but the negatives are undesirably small.

Beamsplitters

Rather than make a completely new camera for stereo work, some manufacturers, right from the old days, preferred to fit mirror or prism attachments to the front of a conventional camera. These are, in a way, like refracting stereoscopes in reverse. At the front, they have two light 'intakes', the same distance apart as the lenses on a binocular camera. The light from each of these intakes is deflected towards the camera lens by mirrors or prisms. The lens thus receives two different images. As these two images pass through the lens, they cross over normally so that they are recorded upside down and back to front. When mounted and inverted, they can be viewed easily in a normal stereo viewer.

The disadvantage is that both halves of the stereo pair are recorded in a single frame. With 35 mm, this means that each image is only 18 × 24 mm—indeed slightly less because there is always some overlap. Quality is therefore limited. Each half of the pair also receives only half the light that a full 35 mm frame would—and possibly less since some light is inevitably lost in the beamsplitter—so exposures are long.

Nevertheless, the method is simple to use and very cheap. It is significant that the only piece of stereo equipment marketed by the big Japanese manufacturers is Pentax's beamsplitter attachment.

Combining images

By combining two or more slides or negatives in a single picture, you can transform the dullest scene or create entirely new and fantastic images of your own

The ever growing popularity of photography as a leisure interest and our increasing familiarity with images in everyday life both mean that it is not easy to produce striking or original photographs of our own. However, one way of creating a fresh view of familiar subject matter is to combine several photos to make a single picture.

Since creative photography is concerned solely with the final image, it does not really matter if a photograph is produced by artificial means. Even as early as the 1850s, artists were making composite prints from as many as 30 different elements. Since then the creative and technical possibilities have continued to expand to a point where there are virtually no limits—you just have to come up with the ideas.

The principal ways of combining images are by multiple exposure (see page 513), combination printing (see page 360), slide combination (see page 1897) and front or back projection (see page 2192). While the techniques vary widely, most of the basic ideas behind the images remain the same in each case. For instance, a combined image of a large moon hanging above a cityscape could be created by any one of these methods.
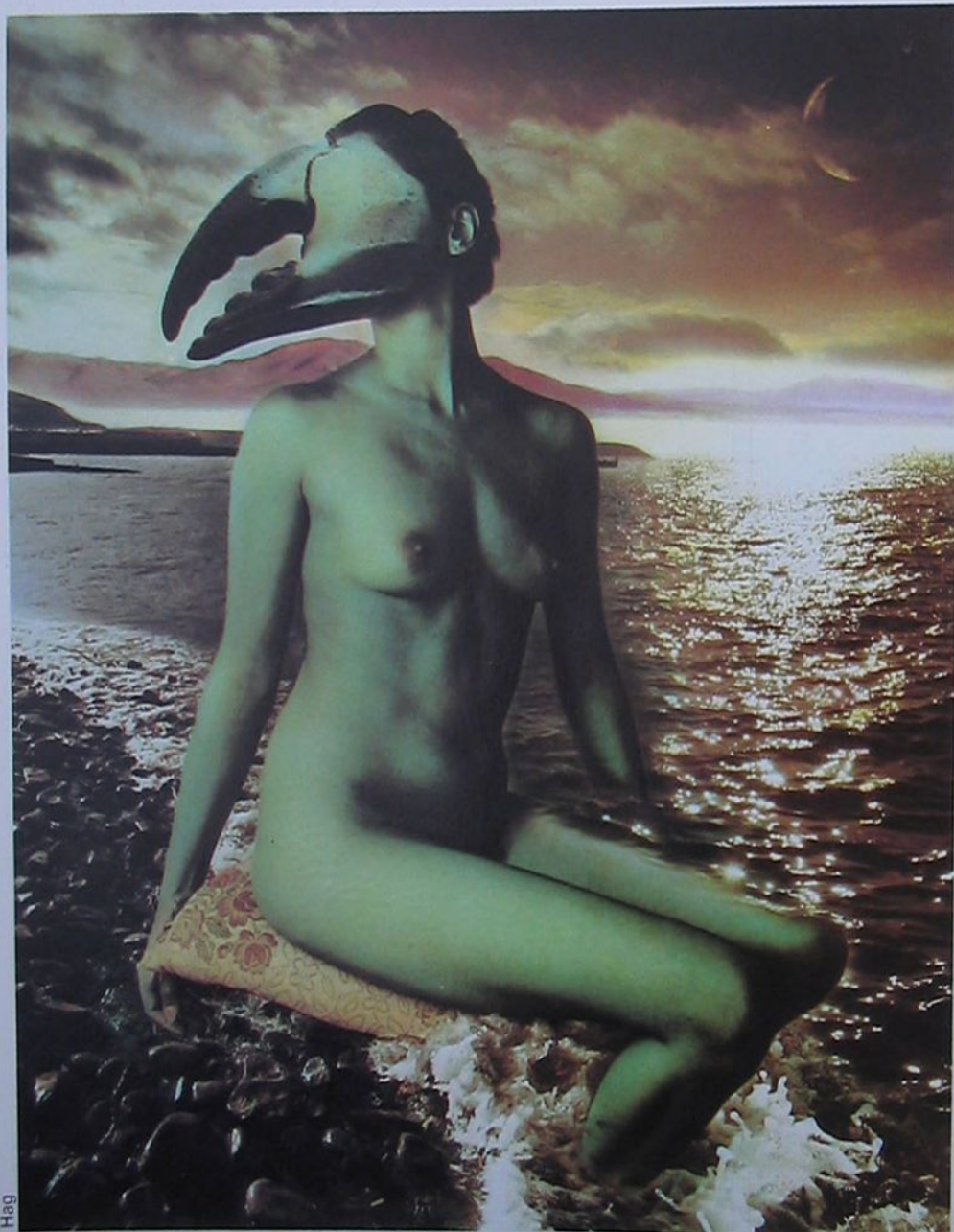
Virtually any image can be used in combination with another and often this process can be an ideal way of improving upon pictures that you have already taken. The advantage of using stock pictures means that you can build upon ideas as you go along and actually monitor the improvements you make. However, while this can be a very rewarding approach, more successful results are likely to come from deliberately planning and composing shots for combinations. This can either be done by making multiple exposures while on location or by collecting stock

Pete Turner/The Image Bank

images to be used at a later date—a dramatic sky or a moon shot with a telephoto lens, for instance.

Combinations of photographs, however they are produced, need to have an original concept behind them. To get an idea of what can be achieved in this field, it is well worthwhile studying the work of photographers who have spent a lot of time making combined images. Many have done a great deal of experimentation and, although you learn through your own trial and error, they can probably help you to make some short cuts. Look at the subject matter they have chosen, how they put their images together and what makes them so effective.

Cityscapes and landscapes

Famous landmarks, such as statues, buildings and city skylines provide excellent material for incorporating the symbolism or surrealism that is often the product of combined images. Since they have all been photographed before, it is

Claw head *With a little practice and subtle-hand colouring, you can combine the most unlikely negatives—here eight—to create bizarre yet convincing images*

Hag

even more of a challenge to come up with something new and unexpected. By using bold shapes, such as a statue against the sky, you can make multiple exposures using different coloured filters, different lenses or both. Using coloured filters with a moving subject, such as pigeons flying around a statue, will give you interesting results where the shapes overlap. Remember, when you are using coloured filters, that it is the highlights that are most affected by the colour. So if you are working against a white sky, choose your colours and viewpoint carefully.

Jerry N. Uelsmann
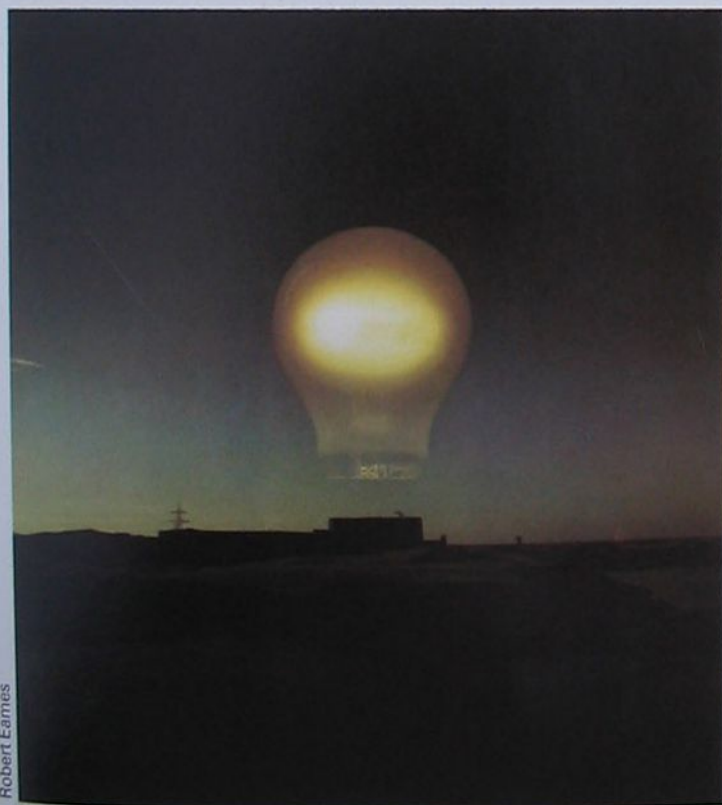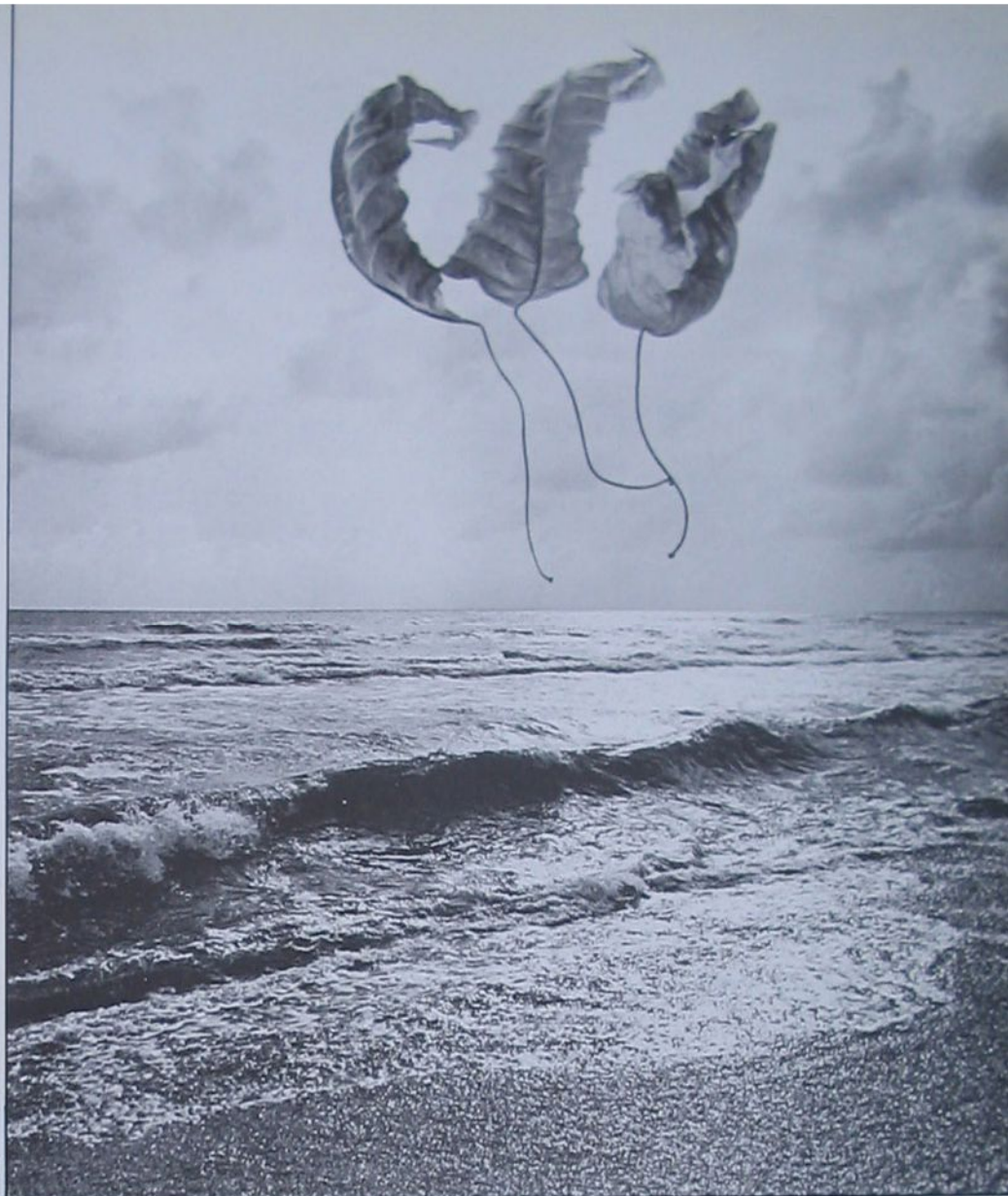
Robert Eames

New York *With the camera mounted on a tripod a whole range of carefully pre-planned exposures were made through different coloured filters to produce this dramatic and powerful image*

Bulb *This double exposure of a power station and an ordinary household bulb demonstrates how important exact positioning is to the effectiveness and impact of the final results*

Leaves *Printing familiar subjects in unfamiliar juxtapositions can create subtle images that reveal an intriguing new facet to the subject*

In a famous city it is possible to combine elements that will convey the atmosphere of the place by making use of a classic landmark, such as a gondola in Venice or a streetcar in San Francisco, superimposed on something much more mundane, such as a line of washing or a smiling face. It is best to keep the images as simple as possible and, if you are making multiple exposures, try and incorporate a black or very dense area in which to position the second image. A gondola would be ideal, as it would act as a frame to the other subject. When travelling it is worth taking pictures that can be used to enliven subsequent shots taken when the weather is dull and uninspiring. A famous building against a bland sky may be much more exciting if it is sandwiched with a high key shot of the interior, or a nearby brightly coloured flowerbed, thrown out of focus.

Combined images for a cityscape are best achieved by photographing a silhouette of the skyline or rooftops at sunset or sunrise. The shadow area can then be used for a corresponding image, such as a wide angle shot looking along the length of the street with the sun setting at the end.

Night is an ideal time for making

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Tree *It is normally vital to ensure that the combined images match in scale. But sometimes you can deliberately mismatch for a surreal effect*

Cellist *An elaborate dream castle built up with a combination of materials and then photographed*

dawn or dusk and use the silhouette area for multiple exposures. Alternatively, shoot during the day and underexpose by several stops.

There are many different elements in nature which are a great source of material and inspiration for combinations. There is a wealth of colour and texture which you can use to create very subjective or impressionistic photographs. Flowers, leaves, ripples of water or sand, shells, rocks, fishes can all be used for close-up detail or an overall effect. You can create the illusion of a mass of flowers when there are only a few by making a multiple exposure and moving the camera each time. Superimpose other images on to larger shapes, such as tree trunks, rocks or animals. A black horse or dog makes a perfect frame for portraying the animal's owner or habitat by double exposure.

Any object that has a strong, simple shape such as a bridge, or an arch or branches, can make an unusual frame for another subject. Similarly, by photographing backlit windows or doors you can use them to create a rather unnerving image—a huge eye staring at you through a window making you feel like you are inside a doll's house or a doorway that opens on to a wide angle shot of a deserted beach.

People

One of the most popular and interesting subjects to be used in combined images is people—perhaps because there is so much scope for using combinations to explore personality.

Portraits are given a new angle when

multiple exposures, especially if you wish to add a giant moon or sun to a cityscape or landscape. It is important to decide first on the kind of effect you want to achieve and adapt the composition and lighting accordingly. If you are using a shot of the moon combined with an unrelated subject, such as a figure or a portrait, try to make the subject look as if it is illuminated by the moon—a blue filter will create the illusion of moonlight. Wide angle images where there is foreground interest such as pebbles on the beach or waves crashing on to rocks, shot with an overhead sun or moon, will very effectively give the illusion of combining great distances or could give an impression of surrealism. You can apply much the same rules to including a moon with landscapes and seascapes. Watch out for an interesting horizon at

Pebbles *Setting a monochrome subject against a coloured background helps to create a weird, slightly disturbing image*
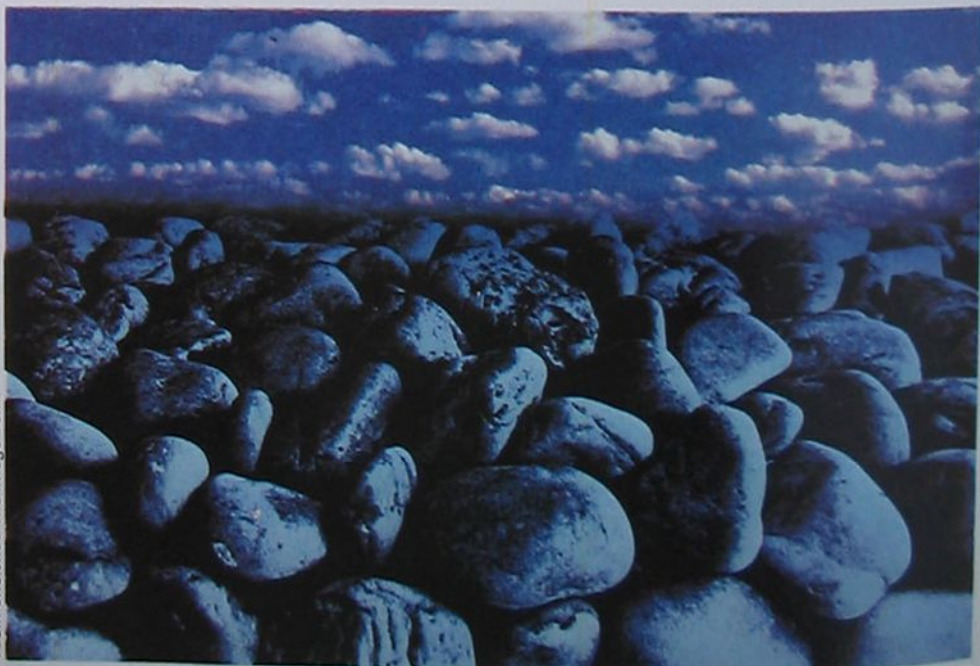
Creative approach

Slab *Combining images allows you to defy all the laws of nature and so pose insoluble puzzles—how does it stay up?*

sandwiched with texture screens, or slides having strong patterns or bright colours. Use masks to put a face into a bed of flowers, or create a ghostly image by double exposing the face with a close-up of a flower. Also try multiple exposures of a face in different positions, to give an all round view of somebody. Or for a more sinister effect, combine one person's face with that of another, or a skull, shot in the same or a similar position. You can create stories about friends through symbolism or illusion. Superimpose their faces over their homes, or experiment with joining an assortment of heads and bodies together. Make analogies by super-imposing a face on to a clock-face, or an object that appears to have a face, such as a car.

Nudes provide endless material for creative imagery and fantasy. Try combining them with landscapes or create the illusion of being underwater by sandwiching a nude with a slide of ripples of water. Make use of parts of the body, such as hands or feet, create repeat patterns, or use them as a silhouette to frame another image. By making use of front projection you can create distorted images. Project the image of a nude or a face on to a shape such as a bottle or a red pepper, and then photograph the two together. Conversely, you can project an image or an abstract pattern on to your model.

Photographing groups of people, such as a family gathering, can be made much more fun by pasting together separate pictures of each individual into a montage. Alternatively, photograph each person with the intention of building up a composite picture, perhaps including a different background for each one, and then fading them together. Montage is especially good for building up crowds of people, or putting them into unlikely places. Record the growth of a child by making a composite photo from shots taken over the years. You can even make a portrait of the way you are yourself changing with time. When making montages, you do not have to make use of entirely your own material. You can use newspaper clippings, pictures from magazines, or anything that takes your fancy. They are one of the most effective methods of political and social comment, and for building up a complex story.

Movement

Combining images is an extremely effective way of capturing movement or creating the illusion of movement. One image can show a variety of static positions of something that is moving. This works very well in natural situations, such as the wind blowing through leafy branches. By making three or four exposures in exactly the same position at a fast shutter speed, the main

branches will be in the same place. Although the leaves may appear to be static, they will all have changed position slightly, giving the impression of frozen wind.

You can show a very slow movement, such as that of a flower opening, by making multiple exposures at set intervals. A black background is essential for shots such as this, and obviously a tripod is necessary to make sure that other key elements remain exactly aligned. A motordrive is very useful for fast action, such as sports. A runner jumping a hurdle can be put on the same frame several times by releasing the multiple exposure or film rewind button. Calculate your exposure for the number of exposures you want.

A strobe flash is ideal for capturing a chain of images in a continuous action. The camera can be set on B, provided that the room is completely blacked out.

Jerry N. Uelsmann

House *Sandwiching the misty photograph of the house with the birds has upset the colours and given an eerie quality*

Alain Choisnet/The Image Bank

Controlled movement, such as a dance exercise or a row of dominos falling over can be displayed very effectively by using a strobe. Strobe is also suitable for showing extremely fast movement, such as the beating of a bird's wings. Also, by combining two different light sources, such as daylight and flash, you can show continuous action as well as the frozen image. A face turning from side to side will appear as a blur on a long exposure, but a series of flashes will freeze the face at intervals.

Shooting images for later use

If you are confronted with a dull landscape or cityscape due to lighting or composition you can liven it up at a later date by making a sandwich of identical, slightly thin transparencies and twisting them slightly around a focal point to create what is called a Moiré pattern. This is particularly effective when there are lots of leaves and branches, pebbles and rocks, or anything with lots of texture. It creates a stippled effect, forming concentric circles around the focal point.

Take advantage of interesting cloud formations or weather phenomena to use

Girl and daisies *A popular way of 'lifting' a portrait is to combine it with an associated or appropriate image*

Monique Fay

Abstract *The subject of the original slide need not be important—it can provide the building blocks for an entirely self-created image*

Ship *A powerful silhouette and a close up of reflections on the water exposed on the same frame for a mysterious image*
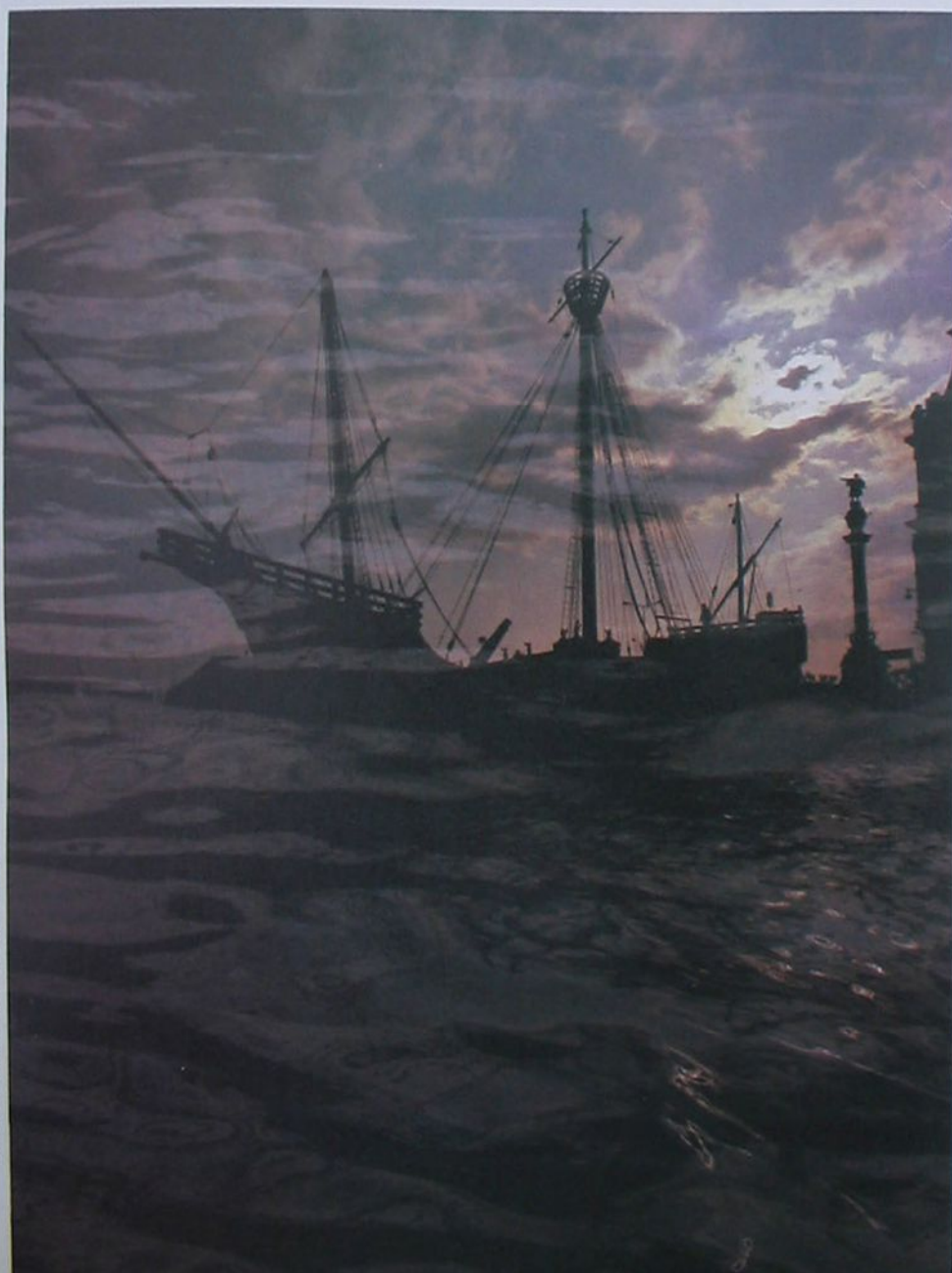
for combinations at some other time. If you come across a particularly dramatic storm above an equally dramatic landscape, it is worth shooting a whole roll of film which you can reshoot for multiple exposures later. Remember to mark the exact position of the film in the camera and take notes of your composition and exposures. It will make excellent material to combine with all sorts of images, and is a chance not to be missed.

A good stock of negatives of spectacular landscapes will be very useful if you want to make photo compositions or montage pictures. You can make up fantastic pictures by combining lots of different elements, such as snow-capped mountains rising up from the sea, or a ship sailing across an ocean of sand. With artful dodging under the enlarger you can transfer New York to the Arizona desert, or the Eiffel Tower to the centre of Sydney.

Adam Woolfitt/Susan Griggs Agency

Country scenes

Landscape photography may seem a leisurely pastime. To James Ravilious, however, it is a very active way of life, as he shows in this assignment using both b & w and colour film deep in the heart of the English countryside

James Ravilious

In many ways, James Ravilious is a landscapist in the classical tradition. His work echoes that of such painters as Constable and his own father, Eric Ravilious. And he confirms his interest in the principles which artists have built up over hundreds of years of painting: 'I spend all my spare time in art galleries,' he says. 'The old masters aren't old hat at all.' But instead of paint, James Ravilious uses a Leica.

Hearing that Ravilious often waits hours for a picture, you might imagine that he works rather like a painter, gazing at a scene from one spot, slowly building up the picture. A tripod, and plate camera, with exposures minutes long on fine grain emulsion? But no. Ravilious in action is more like a photojournalist covering a lively news event. Striding across the landscape in gumboots, he darts around looking for angles, foregrounds, animals, events.

Ravilious spends most of his time photographing his local Devon landscape, deep in a part of the country where tourists rarely venture. He is

photographer to the Beaford Centre, a Devon arts and crafts workshop, and documents the life and landscape of the area. As he goes around, he talks to people he meets. They usually agree to be in his pictures and tell him when particular events are going to happen.

Ravilious uses two Leica bodies, loaded with HP5 black and white and Kodachrome 25 colour film. He uses only 35 mm, 50 mm and 75 mm lenses, with a 90 mm occasionally. He finds that despite using a separate viewfinder to see the field of view, and using the built-in rangefinder, he can work very quickly with Leicas.

Until recently most of his work was in black and white only, but now he uses colour as well. He reserves the colour for shots where it is most appropriate, rather than using it for everything as many people do. He looks for some warm colour in a landscape which is mostly blue and green—it could be a farm roof, or a rusting piece of machinery. Like many others, he prefers using Kodachrome on particular days, when the light is slightly misty and soft. 'Typical English light' he says.

He rates his HP5 at 200, rather than 400 ASA (ISO), and compensates during development by giving 11 rather than 12 minutes development in ID-11 used 1 + 1. This allows him to retain detail in the skies which are so important to many of his shots, without resorting to filters or dodging. 'I don't like XP1, though,' he says. 'You can spend ten minutes at the enlarger burning in the sky.'

Cow and gate *James Ravilious often uses animals as foreground features. On this day the morning light was ideally suited to Kodachrome, which brought out the subtle colours. The warm colouring of the cow complements the landscape hues and aids the composition in what would otherwise be a muddy scene*

Mrs Piper *The wife of a local farmer with the flowers which she enters in local shows. This picture would lose a great deal in b & w*

Stocks *The lower shot shows how a landscape can look very effective in black and white, especially when it is rich in detail, tone and texture. James felt that colour was not necessary until a rainbow appeared, making the colour shot much more worthwhile.*
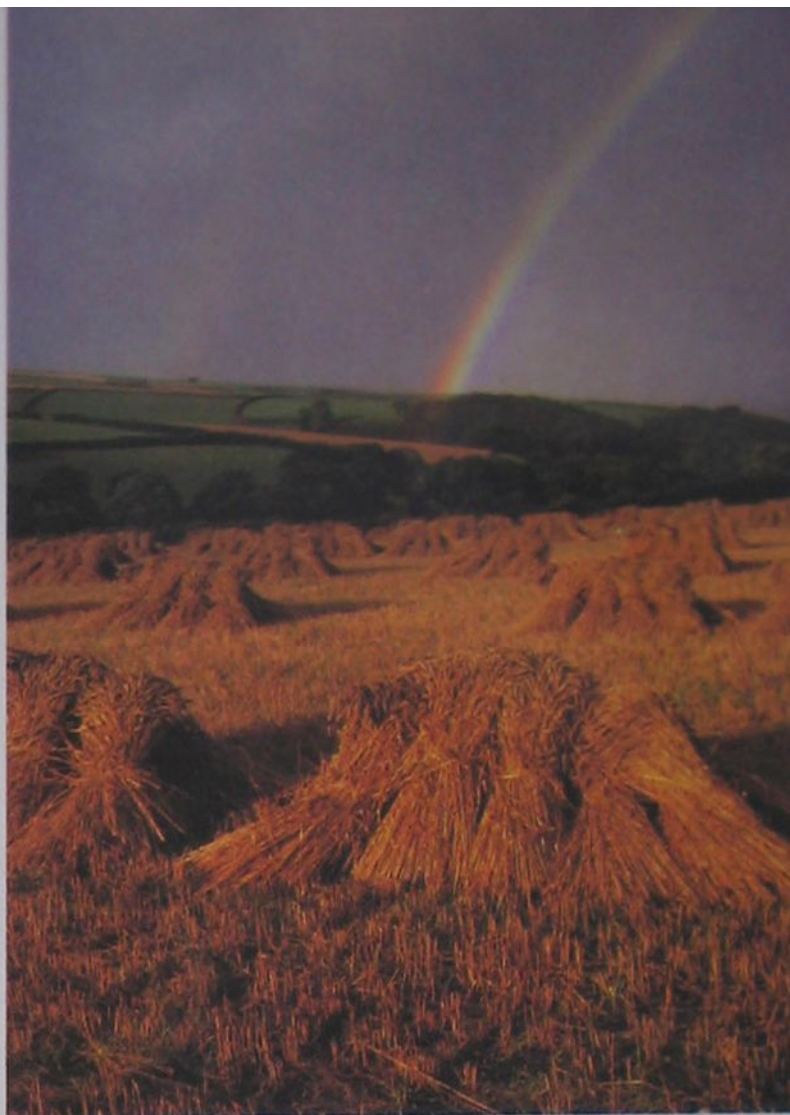
River view *James Ravilious uses the zone system to decide on the exposure—particularly useful where there is a wide tonal range*

Shady lane *This scene was virtually monochromatic, so colour is superfluous. In b & w, however, the tones predominate*

Street musicians

By dropping a coin in a guitar case you can generally make a willing subject of a street musician. The time thus gained for composition, as Ian McKinnell finds with these examples, can be well-used or wasted

Photographing people on the street can be very difficult, for few people have the audacity to be able to confront perfect strangers and snatch their image. To succeed despite shyness, either use surreptitious means—such as using long lenses—or simply shoot people who don't mind having their picture taken. Street musicians will normally fall into this category, provided you leave them a little money! But even willing subjects can be made into bad pictures. The musicians here look bored and disinterested and the composition is certainly uninspired with a clumsy and messy background. The decapitated spectators are particularly noticeable—especially as the drummer is staring out of the shot to where their faces should be. There are many ways this shot could have been improved—waiting for a more interesting part of the act for example, or concentrating on the small child, or perhaps including just the organist.

This picture shows a good idea badly let down by its execution. If you look closely you can see that the image is not sharp so this would appear to be a 'grab' shot taken quickly to try and catch the people unawares. Looking around the faces one can see that this was not totally successful—it rarely is! But there seems no reason to have hurried this shot, the musician would not have scuttled off at the sight of a camera and the passers-by are not in positions that seem worth capturing. The photographer should simply have taken more time and care, waiting until the accordianist was in a more interesting posture and the passers-by made a more interesting group. Then the photographer could have made sure that the focus was correct, seen ugly details such as the black triangles above the musicians head and avoided them and, above all, made this the vertical composition that the image shouts for and made a picture worthy of the idea.
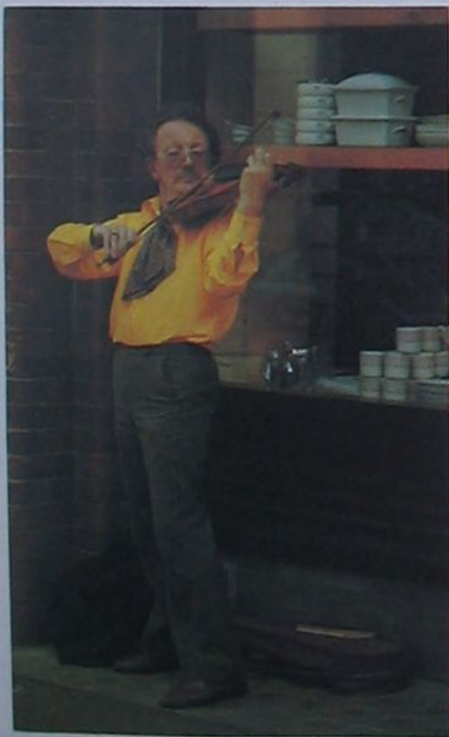
In contrast to the picture above in this shot the photographer has caught the attitude of the musician perfectly. His face is a fascinating example of studied concentration and he has exactly the style and poise that one would expect of a major violin soloist in mid-concert. Yet he is far from being in evening dress and his audience seems to consist mainly of rows of inanimate crockery. It is the gentle absurdity that makes this a successful shot—it contains wit instead of mere humour. The composition is a little weak, but the image is so strong that it still shines through.

This shot shows a careful use of selective focus and has a classical composition and colouring that is entirely in keeping with the subject matter, giving the shot a serene, timeless feel, despite the concrete in the background. The way that the two figures fit together helps to put forward the idea of two individuals playing in harmony. However, the shot might have been improved by using a lower viewpoint to bring the hurdy-gurdy player and the violinist closer together and avoid the distracting shape of the violinists' legs. Always compose carefully.
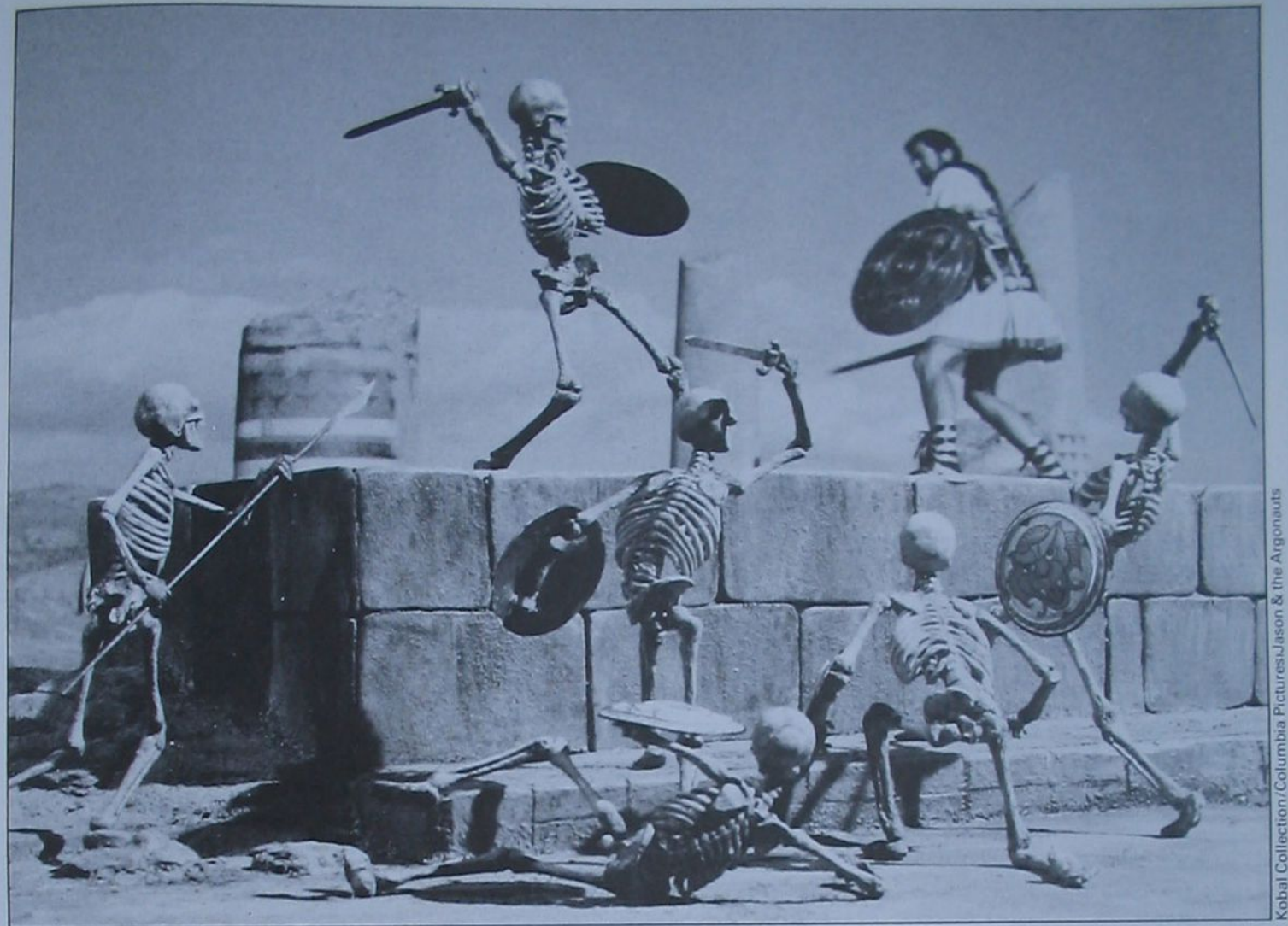
Kobal Collection/Columbia Pictures/Jason & the Argonauts

MOVIE EFFECTS

Special movie effects have come a long way since the days of Buster Keaton and a modern effects department uses an array of sophisticated techniques, often computerized, to create ever more fantastic illusions for the movie goer

Special effects are as old as the movie itself. In fact, many of the earliest films used trick photography almost exclusively to make their impression on the viewing public. Most of the early special effects techniques developed then are still in use today. And recently they have been augmented by a new generation of complex technical effects especially devised to meet the demands of the blockbuster science fiction productions and commercials. These special effects techniques may be applied at any one of the numerous stages of film-making—ranging from changing the film speed or using miniature models while filming to the use of optical effects at the printing stage or computer graphics.

Jason and the Argonauts *Models are brought to life by patiently adjusting them, and shooting them frame by frame for every movement*

Trick photography
The basic techniques of trick photography can be used with even the simplest of home movie cameras. For example, by simply filming the action at a faster or slower rate than normal, movement will appear to occur at a slower or faster rate when the film is projected. Another basic example of trick photography is the *jump cut*. Here the camera is stopped while a change is made to the scene and then restarted. If every other element remains the same then the cut will be undetected except

that something has appeared, disappeared or moved inexplicably.

The same technique is used to substitute a model for a real actor, so that the model can then be dismembered, blown up or otherwise violently dealt with. Television comedy shows make frequent use of such effects and they were used for such horrific scenes as in *Scanners* where people's heads explode.

To make an object disappear slowly, a *fade* is used. This can be done in home movie cameras with a *dissolve* feature by reducing the exposure to fade out the first scene, then rewinding the film and fading in a second scene—with the object removed—by increasing the exposure from zero. In professional movie work, this effect is not performed
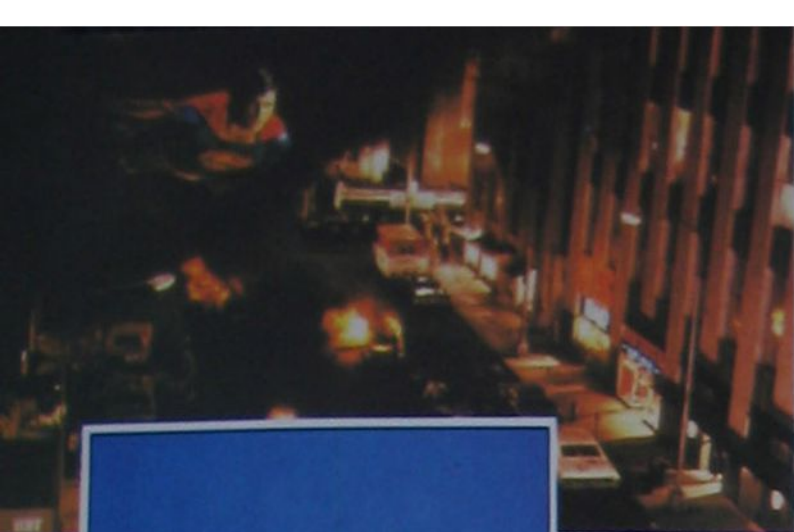
Superman, *supported invisibly, is filmed against a blue background*

A negative matte is made by means of blue-colour separation

This negative matte is used to produce a positive counter-matte

The counter-matte leaves a perfect 'hole' in the cityscape film

Into this 'hole' the moving film of Superman is superimposed

When Superman flew, *he was filmed suspended by a wire for a travelling matte. This sequence was then superimposed on a model scene using the blue backing system*

Mini set *This small scale set of the Metropolis was used interchangeably with another which was identical in every detail but life-sized*

in the camera as it is costly and time consuming. Instead, the before and after scenes are shot straight and the dissolve is done in the same way during printing.

This is done using an *optical printer*, which is an essential tool for many special effects, including titling. It consists of a movie copying system in which two films can be copied on to a third, combining the two images. Here, instead of the camera being stopped just once while a change in the scene is being made, the camera is stopped after every frame. This produces an effect analogous to cartoons. Models can be animated and inanimate objects can be made to appear to come alive. This was once used to animate model dinosaurs in early science fiction films, but it rarely looked convincing and it is now used sparingly in conjunction with other special effects techniques.

One of the directors who favours these effects is Ray Harryhausen who used them in *Clash of the Titans* and in the battle of the skeletons in *Jason and the Argonauts*.

The use of very small apertures, with their extreme depth of field, allows small models to combine realistically with actors. By arranging the relative distances from the camera of the foreground model and the actor, perspective can be used to alter their relative size at will. Precise positioning is the key to achieving convincing results. These perspective shots are created by art departments who work out all the angles. Scenery is then built to present the fixed camera with a false perspective. Whenever movement is involved, such as flames or waves, the scene is often shot at a faster rate but projected at the normal rate. This slows down the motion and gives the scene the appearance of being larger than it really is.

Optical effects

Many of the optical effects used in movies, such as the *glass shot*, were first invented by still photographers in the 19th century. For this, a painting is made on a sheet of glass which is then positioned in front of the camera so that it

blends in with the real scene behind. The same method can be used to remove unwanted features from a modern scene being used in a historical movie.

One of the most widespread optical effects is the *matte shot*, which has been used since the early days of the movies, though recently the technique has become much more sophisticated. In its simplest form, one part of each frame is blanked out by a card, called a matte, held in front of the camera lens. The film is then wound back and a new scene is filmed with the previously exposed portion of each frame obscured by another card whose shape is exactly the reverse of the first. This is called a counter-matte. The result is a double exposure where each exposure occupies a separate portion of the frame. In the days of silent films the technique was used so often that cameras had special matte boxes built on the front of them. These days it is more convenient to perform matting at the printing stage when the technique can be used with far more precision.

A variation of the matte shot is one that makes use of a matte painting. After filming a scene with part of the frame 'matted out', the partially exposed film is transferred to another camera, heavily weighted to prevent vibration. This is positioned in front of a sheet of black glass. An artist then paints a scene—usually background scenery and interesting skylines—on to the glass. The painting is then filmed with the black, unpainted section of the glass acting as the counter-matte. One of the most famous contemporary matte painters is Albert Whitlock who produced the grandiose scenes used in Mel Brooks' *History of the World Part I*.

A later development of the matte shot is the *travelling matte* which is used extensively in the *Superman* films to show Superman in flight. Here the matte is not a static shape, but moves—or travels—with each preceding frame, as when moving figures are shown against a changing background.

One way to achieve this is to produce a separate matte and counter-matte for

Beam me down, Scottie!
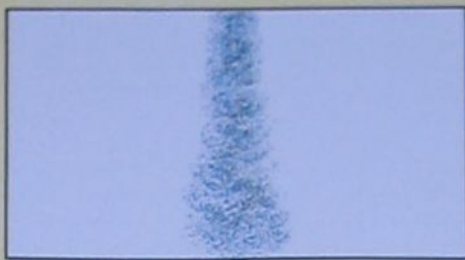
To achieve Star Trek's famous beaming down effect, three different images are combined. Still photographs of the background with and without Spock provide the first and last images of the sequence. A moving shot of aluminium chaff falling (filmed upside down) gives the glitter effect. A matte is made by cutting around Spock's figure. Using this the image of Spock is gradually faded out while the glitter fades in. The glitter is in turn faded out and this sequence is then superimposed on the background. In the final sequence Spock's figure fades into glitter and then disappears

each frame by hand. This is a laborious process similar to cartoon animation, but it can be very realistic.

A quicker and cheaper method of making a travelling matte makes use of the basic properties of colour photography. In the *blue backing system*, the foreground action in a scene is lit with normal white light and photographed on regular colour film against a blue background. This is either a blue-painted back cloth or a translucent blue scene lit from behind. The colour and lighting level of the backing is such that it produces an exposure only on the blue sensitive layer of the colour negative to a density greater than that of any part of the foreground. This means that you can make a blue colour separation of every frame which will form a perfect matte and counter-matte—the negative will be the matte and the positive the counter-matte. In *Superman* the hero's costume was coloured a deeper shade of blue so that it did not blend in with the light blue matte.

The matte and counter-matte reels are

Phased out *Like many SF films, 'Star Trek II' used models and computer controlled cameras to create this battle in space*
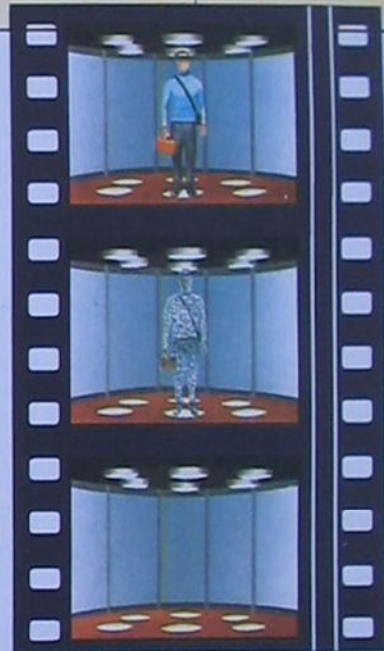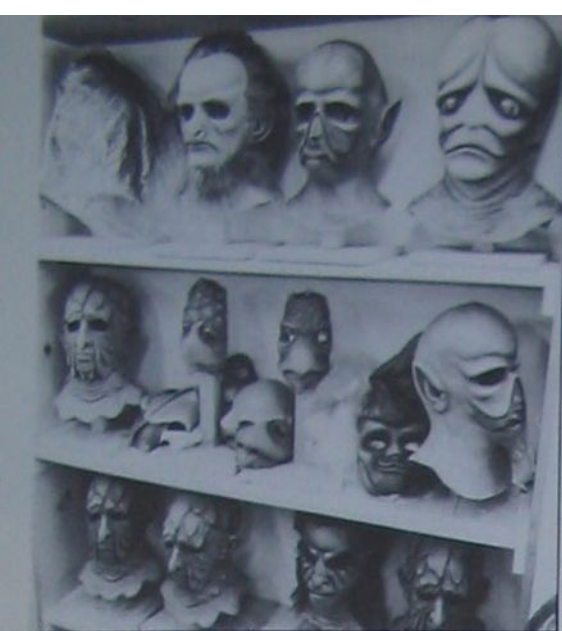
Masks *Modern masks, such as these from Star Trek, are made from latex, which allows a range of lifelike movements impossible with cruder materials*

run through an optical printer in synchronization with the film from the camera, blanking out the unwanted portions on the final print. Blue backing is also used in video and television now, with a separate picture signal being fed in on the blue channel. Thus a news-reader sitting in front of a blank blue screen will appear to the viewer to be sitting in front of the relevant news pictures.

More traditional methods of com-bining a separately filmed foreground and background are the techniques of front and back projection (see pages 2192 to 2195). In back projection actors stand in front of a translucent screen on to which background action is projected from behind. The projector and the camera have to be synchronized so that one frame of the background is being projected at the same time as the shutter of the camera is open.

Bullet wounds *For realistic gunshot effects small explosive charges containing artificial blood are detonated in the actor's clothing*

A later variation of this technique is called front projection and was used in the opening sequence of *2001*. Here the background is projected on to a particular type of screen in the same line of sight as the camera. This is done by means of a lightly silvered two-way mirror positioned at 45 degrees to the line of sight, just in front of the camera. This reflects the projected image on to the screen. Since the projection is in the same line of sight as the camera, no shadows are visible around the edges of the actors—their bodies mask their shadows exactly. The screen is built of a special highly reflective material con-sisting of millions of tiny glass bead reflectors. This gives a bright reflection in the direction of the projected beam so a comparatively low intensity beam can be used that will not show up on the well-lit actors.

One of the more modern techniques used in films like *Star Wars* and numerous television commercials is *slit scan*. This effect shows an after image snaking out behind a moving object and conveys the impression of flight. It was used in the corridor of light sequence at the end of *2001*. It has taken 30 years to develop and is, in effect, time-lapse movie photography.

The original action sequence is filmed, and this film is then developed and enlarged and taken to a *rostrum camera* —the type of fixed, precisely adjustable camera used in making cartoons or filming still photographs. Each frame of the original sequence is then filmed as if it was one of the 'cels'—or celluloid pictures—of a cartoon. The camera is loaded with time-lapse film and is panned across the enlargement. Precisely the same movement is used on every subsequent frame until the whole sequence is transfered.

Sometimes the image is also strobed with light while being shot. This produces a series of after-images instead of a single ribbon. Slit scanning is also used on titles to give the impression that they are flying as in the title sequence of the *Superman* films. Here, the original artwork is moved across the rostrum, millimetre by

millimetre, frame by frame. To add perspective movement to flat artwork, the rostrum camera may be zoomed as if is being panned. This generates growing or diminishing after-images, depending on whether you want the titles to appear to be flying towards you or going away.

Such is the precision of rostrum cameras that they are now being used under computer control to film moving models. One of the first major uses of this method was in *Star Wars*. Computer linked cameras were designed to film model shots in real time—that is with the camera cranked at 24 frames a second for film to be shown at 24 frames a second—thus overcoming some of the aritficial feel of sequences normally filmed 'stop frame'.

The camera is mounted on a *dolly* that can run up and down a track, and the camera itself can move from side to side or up and own. It can also pan in any plane and zoom. The models too are mounted so that they can move, turn or incline in any direction. The control of both the camera and model is then turned over to the computer so that their relative movements can be co-ordinated, altered and precisely repeated until they are right.

Computer graphics
These days computers can also be programmed to depict three dimen-sional images on a flat screen and then change these images so that they can be seen from other angles. Block colour can be added and entire cartoons can be drawn and animated with the aid of these machines without a single sheet of paper of celluloid being used.

Until recently the resolution produced by these techniques was not fine enough to satisfactorily transfer these images to 35 mm film. But now using the latest digital computer techniques colour and intensity can be assigned to each of over two million points of light—or pixels—on a special computer screen. These flesh out the electronic images while the computer choreographs their move-ments frame by frame. This computer-created world can then be peopled by matting, as in the Disney film *Tron* and *Star Trek II*.

Computer graphics are often used in animation. The moving outline of these computer images are shot on black and white lith film and the negatives can then be used as cartoon 'cels' with the colour being painted in by hand.

Mechanical effects
Special effects in the movies also embrace an area that lies well outside the area of photographic and optical trickery. Bullet holes appearing, blood spurting from wounds, buildings collapsing, all kinds of fantastic monsters and model making all fall into the classification of special effects.

Realistic bullet wounds were first used extensively in *The Wild Bunch* in 1977. The actor wears a small explosive charge attached to a plastic bag full of
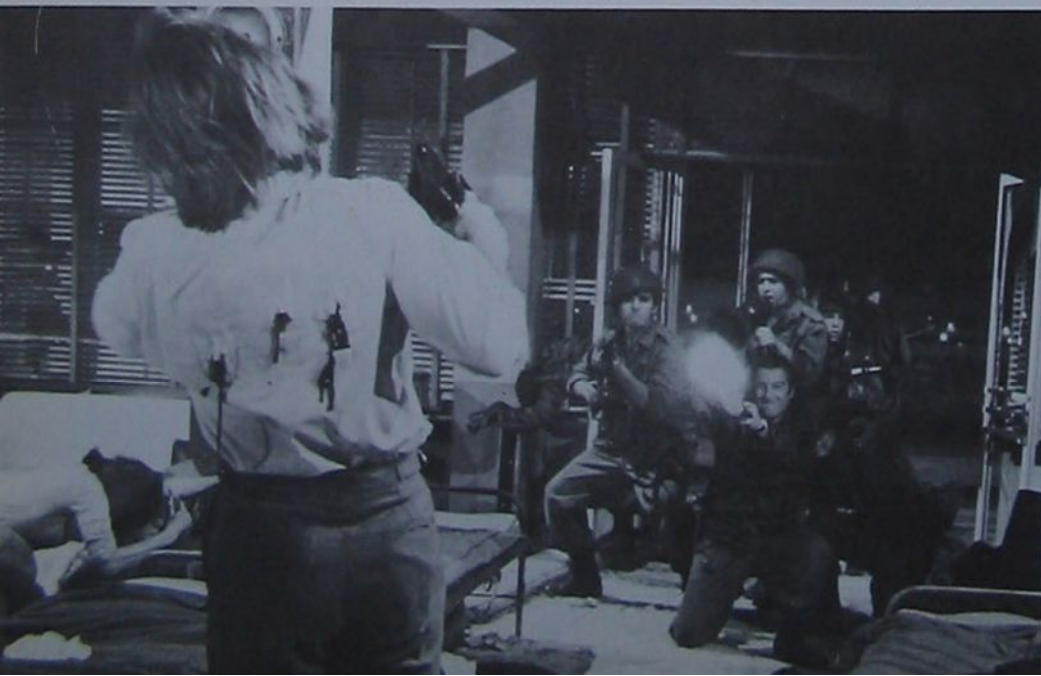
'2001' *The effect of weightlessness is achieved by filming vertically up a tunnel with the actor suspended on a rope and then slowing the film down*

artificial blood which is concealed under clothing. When the explosive is detonated—either by the actor or remotely—it blows a hole in the outer clothing and releases the blood, giving the impression of a gunshot wound. The actor is protected from this explosion by a protective plate.

Stabbings are simulated by the use of knives made of resin and coated with metallic paint. Artificial blood, contained in the handle, is squeezed out through small vents in the blade. Spears and arrows fly to their target guided by fine wires attached to cork-covered metal plates worn by the actors. The spears or arrows, which are hollow, are propelled along the wires by pneumatic devices off camera. Or, where possible, arrows are fired out of the target and filmed in reverse action.

Full scale explosions and fires represent the more spectacular work of physical effects men, who must be fully qualified explosives experts. One of the most dangerous effects is the simulation of people burning. The safest way to achieve this effect is by using a small gas burner that an actor can wear over fire-proof clothing. When the gas is ignited it appears that a portion of the actor's clothing is alight, but the flames vanish as soon as the gas supply is switched off. Another method is for the stunt man to wear protective clothing smeared with alcohol which creates a vapour barrier between the flames and the clothing.

To create the illusion that a building is on fire, effects men use special units which pump paraffin to burners placed in windows. Colouring agents are added to the fuel as regular flames tend to look transparent on film.

Model effects

Recently, great strides have been made in the field of model animation with the use of model latex foam. This spongy foam stretches and bends like skin,

giving models, masks and costumes a very lifelike quality.

As the foam is moulded a number of exact replicas of models and costumes can be made. Then, during filming, one section can be shot using a model and the other using an actor dressed in an identical costume so that the two sections can be interspliced later. This accounts for the extraordinary lifelike quality of the scenes showing the wiseman Yoda walking in *The Empire Strikes Back*. Every time your mind begins to reject the artificial feel of the model being animated by stop frame, the film cuts to a costumed actor moving in real time.

The other major use of latex foam is in transformation scenes—such as in *An American Werewolf in London*. Here small motors were installed under the foam to distort the shape of the body— the knuckles move up the fingers, the mouthpiece pouts, the knees change position. This is very convincing as most of these excruciating changes appeared to take place in real time.

Computerized cameras *This is one of two fully computerized motion control cameras used for special effects in films such as 'Superman' and 'Superman II' and in countless commercials*

Aerial image camera *The height of special effects technology, this aerial image camera is used for a wide range of techniques such as split screen, optical zooms and travelling matte effects*
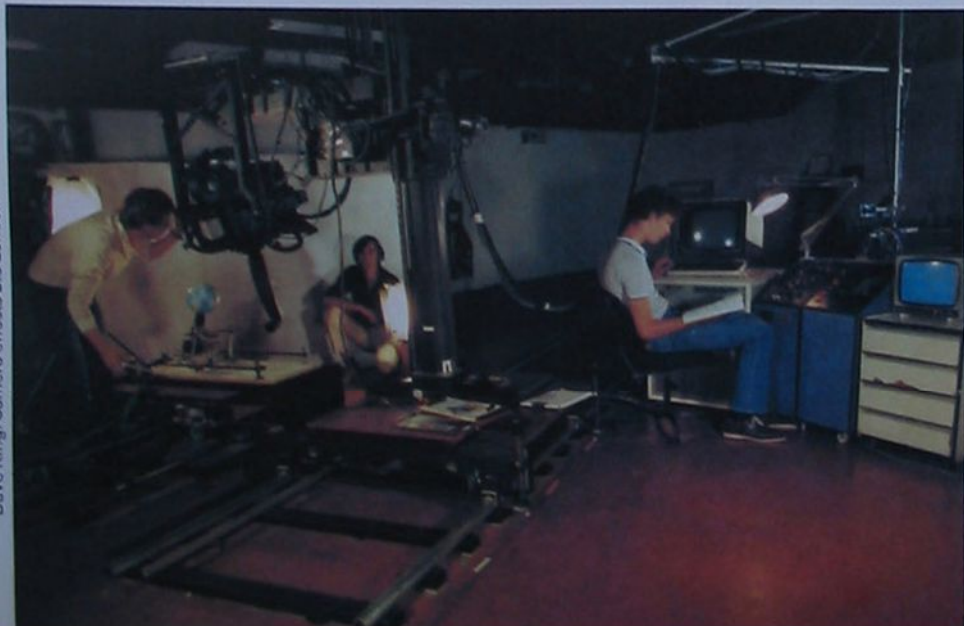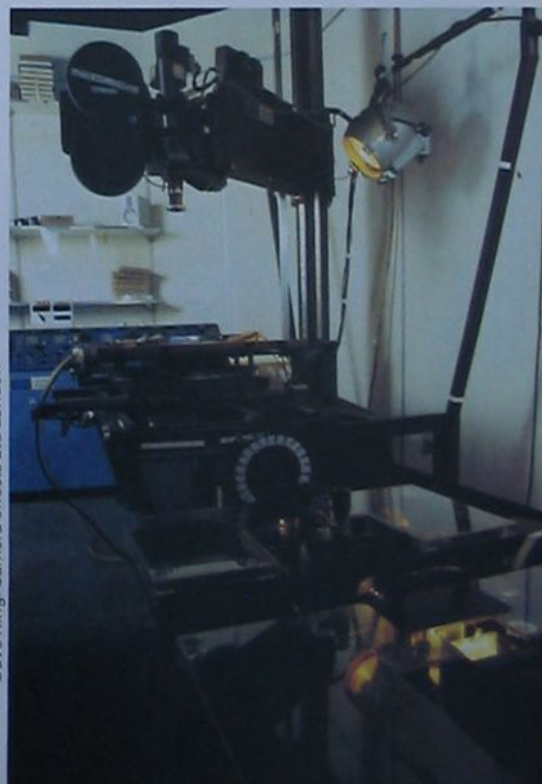
NEWS STORY

Press photography demands special skills so we followed the 'Daily Star's' Alasdair Loos around for a day to see what was involved

Press at work *On assignments like this—to show Alan Whicker's return to the BBC—there is seldom any chance for Alasdair Loos (arrowed) to work alone with the subject*

Much of the work of a press photographer working for a daily newspaper like the British *Daily Star* is a fairly routine. Only occasionally is there the kind of drama that can make the job sound so exciting. But on the day we chose for our assignment with *Star* photographer Alasdair Loos, we were lucky enough to see both sides of his work.

Alasdair is the *Star's* show business specialist, so much of his work involves photographing personalities, and his first job of the day was a typical assignment to photograph TV personality Alan Whicker. Yet although this kind of work is routine and Alasdair was working alongside a dozen or so other photographers from other papers, there is considerable skill involved in getting the picture to tell the story. This job was to show Alan Whicker's return to the British Broadcasting Corporation after a long absence, so certain elements had to be in the picture—the BBC sign, for instance, and Whicker's brief case.

The second job seemed also to be routine. Alasdair has covered the various stages of the Miss World contest before and his job that evening was to photograph the winner of the Miss United Kingdom title. However, during the evening events took an unexpected turn. The contest had been sponsored by a fur company and, as Alasdair was getting ready to take his shots of the winner, a group of people stormed the stage to protest against the killing of animals for their fur. Alasdair responded quickly to the new situation and managed to get some dramatic shots of the protestors being hustled from the stage.

It is in this kind of unexpected situation that it pays to know your equipment well—otherwise you may miss all the action while making adjustments. For Alasdair, equipment is generally Nikon F3 cameras and three lenses: 35 mm, 135 mm and 36–72 mm zoom. Nearly always, he shoots on Kodak Tri X rated at 400 ASA (ISO).

As soon as the scuffle was over, Alasdair got his shots of the new Miss UK and rushed his film back to be processed. Barely 30 minutes after the paper receives the exposed film, the contact sheets can be on the picture editor's desk ready for inclusion in the following morning's paper.
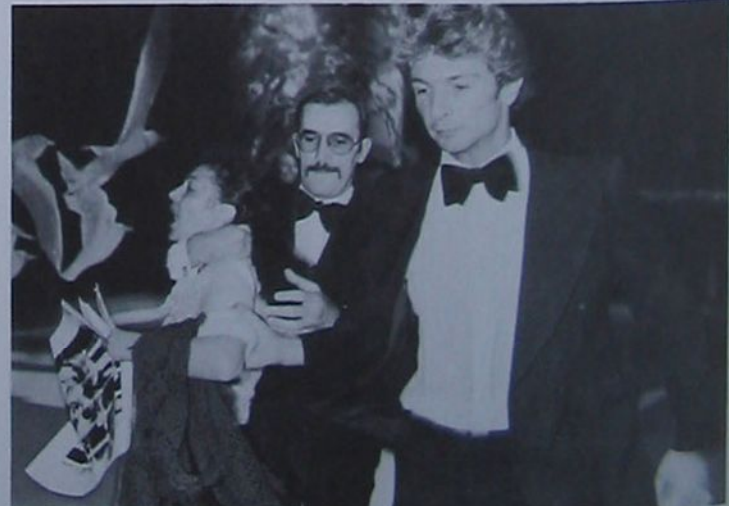
Beauty contest coverage *Alasdair Loos was fortunate enough to be right on the spot when what promised to be a normal contest, turned into a potentially explosive situation. Demonstrators stormed the stage and amid the confusion Alasdair rushed up to take as many shots as he could. The picture below left relies for its impact on showing the beauty contestant in such an odd context.*

The shot above right could appear much smaller as the raised fist gave it such impact. Alasdair also took several different formal shots of the winner, two of which appear below. The 'Daily Star' chose the winking shot which gave them a more unusual, jaunty front page shot

Lens manufacture

To give the kind of quality professional photographers demand nowadays, lens must be made to high specifications using the right materials. Only by sacrificing quality can the manufacturing process be simplified and the cost to the customer brought down
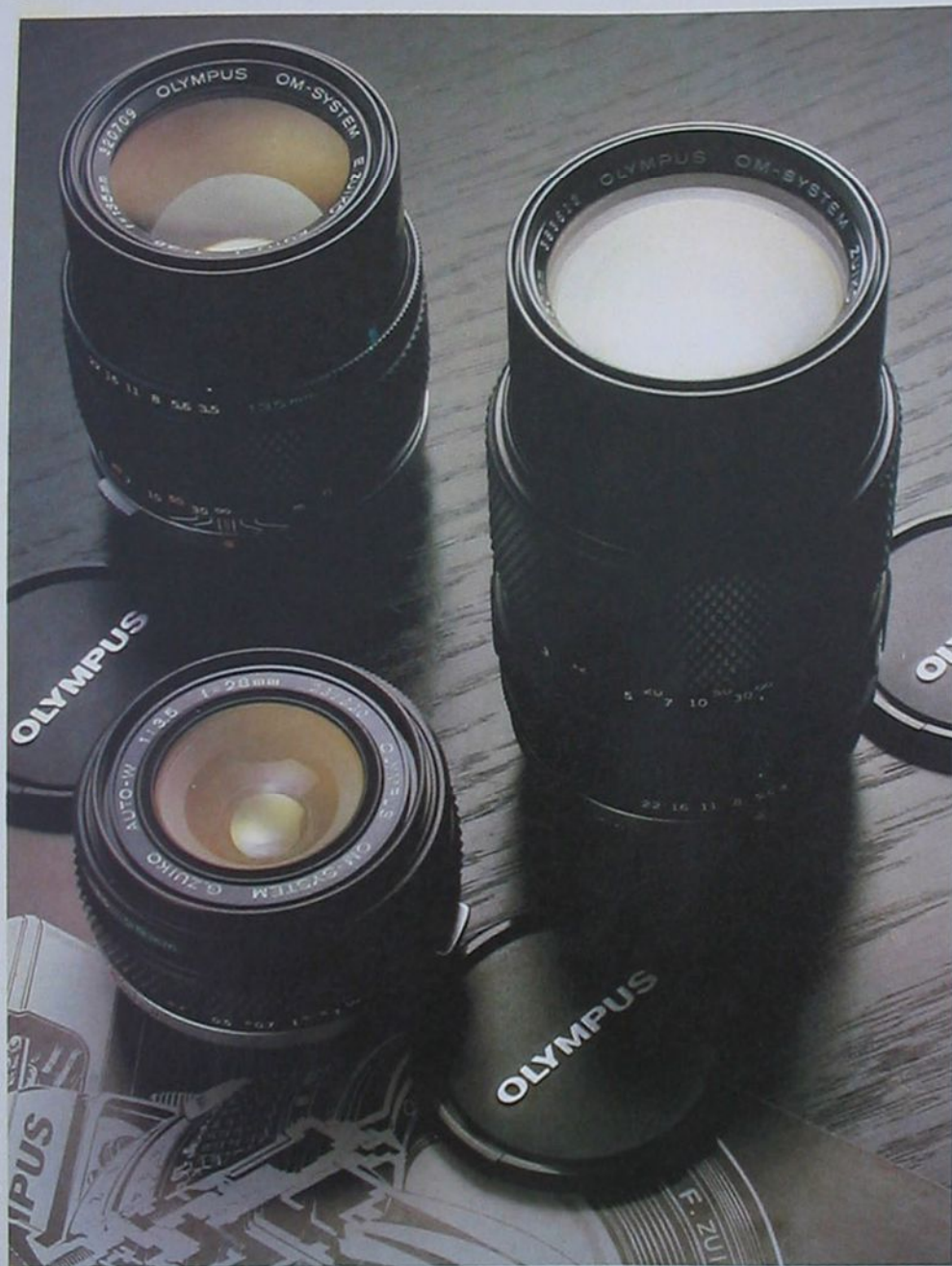
When you buy a lens, you can usually be sure that the price reflects the ease of manufacture and the quality of materials used. To produce a high quality lens, manufacturers must follow certain principles in construction and choice of materials. Although there are notable exceptions, any attempts to cut corners in manufacture will reduce the quality of the lens considerably.

Modest designs *Simpler design and fewer elements mean these lenses are cheaper to make than the high speed designs*

The greatest pitfall for purchasers is the attempt by manufacturers to present the best specifications for their products—so that they look good on paper. In pursuit of this, many designers over-extend both themselves and their lens designs, so a purchaser is likely to benefit by choosing slightly more modest designs.

At the cheaper end of the market, for example, you are better off buying an f/3.5 28 mm lens instead of a superficially more attractive f/2.8 or even faster lens. This is because of the way in which lenses are made. Lens production involves grinding and polishing the glass, making the mount and installing the lens, then incorporating the linkages for accessories such as the diaphragm, metering, and autofocus—and each aspect has its effect on the final design and price.

The glass

Glass is fragile, heavy, difficult to work and expensive, but it has proved to be indispensable. Optical plastics have been developed, but they are insufficiently versatile. And other possible substitutes have even greater drawbacks than glass—fluorite, for example, is even more expensive and fragile, and deteriorates gradually with age.

The cost of glass can be a major factor in lens production. Most optical glasses are about ten times as expensive as ordinary plate glass, and some of the specialized glasses, such as the high refraction–low dispersion types, can cost ten times as much again. So, the more exotic lens designs can be extremely expensive in glass alone.

The fragility of glass is less of a problem, but it is by no means negligible. For example, a steeply double-convexed glass has only a thin edge for support and centring. A thicker edge will solve the problem, but only by creating others. Another minor problem is corrosion resistance. Some of the older optical glasses were susceptible to atmospheric corrosion or tarnishing. Today, this is solved by coating the glass.

Modern optical glasses can be astonishingly heavy. Although this may not matter on a small, simple design, it becomes important on ultra-fast lenses or the longer focal lengths, especially with the current fashion for compactness and lightness.

Grinding and polishing the glass is expensive, but it becomes even more so for deep curves, and worse still for aspheric surfaces, which have to be optically worked by hand. The cost of working is greater than the cost of materials, so lens designers are urged to use relatively shallow, common curves and as few elements as possible, even if this means using exotic glasses.

On the other hand, two spherical elements might cost less than a single aspheric. As new glasses are developed, it is often possible to redesign a lens using fewer elements or simpler curves: the 50 mm f/1 Noctilux has seven elements but no aspherics, whereas its f/1.2 predecessor has six elements in addition to aspheric surfaces.

The use of additional elements, aspheric surfaces or newer glasses

allow the designer more scope. Generally, however, the trend is to reduce the number of expensive elements. Compared with the Noctiluxes, the 50 mm f/2 Summilux has six elements and no aspherics, the 50 mm f/2.8 Elmar has four elements and no aspherics. Similarly, the Vivitar 90–180 Series 1 f/4.5 has 18 elements (no aspherics) and the Vivitar 17 mm f/3.5 has 11 elements (no aspherics). The extra elements become essential as more speed, retrofocus design or zoom capability is introduced.

The mount

The lens mount should be strong and rigid, to hold the glass accurately in place. It should retain its dimensions in hot or cold weather, so the glasses are not loosened or shattered by changes in clamping forces. Stable dimensions are also essential for accurate, reliable focusing. In addition, the mount should be easily worked to close tolerances, yet still resist wear due to the focusing movement.

Brass meets these requirements admirably, but it has lost favour because it is heavy. Light alloys are increasingly common. Used alone, however, they are prone to excessive wear, so the better lenses use either brass-in-brass with light alloy for applications in which wear is not a problem or light alloy and brass. Cheap all-alloy lenses are normally greased with thick lithium or aluminium stearate greases to hold the mating surfaces apart. This is fine if the lens is fairly new and receives little use, but problems develop as the grease ages.

In a conventional mount, there are essentially four groups of components. The first is the lens cell, the second is the diaphragm, the third is the focusing movement, and the fourth comprises the

Camera-to-lens linkages *Electrical tellers are used more and more in modern linkages because they are quicker and more compact than mechanical systems*

Multi-start threads *are harder to produce than modern focusing movements but quicker to use.* **Modern diaphragms** *have fewer leaves so that they are light and can be stopped down almost instantaneously*

camera-to-lens linkages. In a zoom lens, there is also the zoom mechanism, and in a shift (perspective correction) lens there is the decentring or *revolving* mount.

To this day, lens cells are often made of brass. It can be turned with extreme accuracy, and brass retaining rings can be screwed tightly to hold the glass in place. It is, however, possible to use light alloy, perhaps even with spun-in mounting, or even plastic—the lens cell should not move, so wear is not a problem.

The lens cell is mounted in a sleeve, which bears the actual focusing mechanism. Nowadays, the usual mechanism is a set of three helical

Internal focusing assembly *for a 75–150 mm f/4 zoom. The diagram on the left shows: A–the focusing ring assembly, B–the front optics, C–the main frame into which the optics are mounted, D–the rear optics, E–the centre optics, and F–the zoom optics. Some zooms have as many as three sets of zoom optics moving at different rates and in different directions. These are more difficult to make but give better image quality*

grooves into which pins locate. As the collar is rotated, the lens slides in or out on the pins. This is a simplification of the *multi-start* thread, which is still used in some of the better lenses. It allows a much coarser movement than would be possible with a simple thread, so the full focusing movement can be achieved in a rotational movement of 45° to 270°.

Whatever the type of mount, it is essential to reach an acceptable compromise between a fine movement (which gives a greater accuracy in focusing, but is slow to use) and a coarse one which is quicker but less accurate. Simple mounts, such as those on the early Elmars (and still found on Russian lenses) enable the whole lens to rotate during focusing.

The *rectilinear* mount, in which the cell moves to-and-fro without rotating, is more expensive but more convenient to use, as well as making coupling easier; it has mostly supplanted the rotating mount. For close-focusing lenses, such as the Micro Nikkor, double helical mounts with concentric tubes are often

used—as soon as one mount reaches the limit of its travel, the other starts turning.

On most modern lenses, the diaphragm is operated automatically by pressing the release button. Because of the need for speed, modern diaphragm leaves tend to be fewer in number than previously,. This ensures that weight and inertia are kept low. Usually, the leaves are lubricated by being coated with the plastic PTFE (Teflon), instead of grease, which can bind. On preset and manual lenses, it is possible to use a stiffer diaphragm with more leaves, so they approximate more closely to a circle.

The camera-to-lens linkages are numerous, and new ones are introduced frequently. First, there was the auto-diaphragm pin or lever. Then came a maximum aperture teller and diaphragm teller for full aperture TTL light metering—tellers indicate to the camera or meter mechanism what setting to use. Now, to these are added dedicated flash tellers, servofocus posts, focal length tellers, autofocus tellers, and more. Increasingly, this information is relayed

electrically, which is a much better solution than the very complicated system of tiny protrusions and linkages used earlier.

In some zoom lenses, the zooming movement is controlled by a simple push-pull action, but helical movements similar to those used for focusing are more usual. Thanks to modern numerically controlled cam-cutting machines, it is not unusual to move three groups of elements at different rates and possibly in two different directions. This allows better compensation for changing focal length, and results in better image quality.

Zoom lenses focus by moving one or more groups of lenses inside the zoom, and this technology is also used in lenses of fixed focal length. In some, it is used for internal focusing, and in others a 'floating element' moves during conventional focusing to maintain correction as the lens is focused closer. This is an expensive arrangement, and is normally found only on expensive and highly corrected lenses.

Shift lenses normally decentre the lens body with a simple 'dovetail', often with some form of rack-and-pinion drive for fine control. The mount also revolves, so that the decentring movement can serve as a cross front, a rising or drop front, or a combination of both. It is difficult to maintain diaphragm and other linkages on such lenses, so these are normally not incorporated.

If there are no linkages, it is also possible to use a single mount for a

number of lenses—usually long focus preset types. Leitz, Nikon, Novoflex, and Canon have produced such an arrangement. It increases the cost of the first lens, because you have to buy the mount, but it is cheaper for subsequent lenses.

Assembly and testing

In almost any lens, regardless of price, the glass is well ground and well polished. Coating is normally first-class, too, though multicoating is of dubious value on some surfaces—the better manufacturers tend to multicoat only those surfaces that need it.
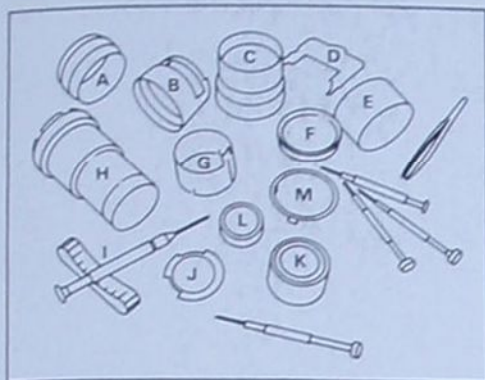
The major differences come in the quality of the original design, the quality of the mount, and the centring and spacing of the elements. The quality of the mount and the alignment of the elements are closely related. The lens cell must be slightly greater diameter than the glasses, to allow for expansion. So a certain amount of axial displacement (in which the optical axis of an element is misaligned with the optical axis of the lens as a whole) is inevitable. Careful manufacture and assembly are essential to keep this displacement to a minimum.

Zoom interior *A dismantled 75–150 mm zoom and some of the tools used in lens assembly. The diagram shows: A–the zoom ring, B–the P-ring, C–focusing ring assembly, D–calliper tool, E–lens hood, F–front optics, G–frame (zoom) guide, H–main frame, I–lens tool and rubber grip, J–rear mask, K–zoom optics, L–centre optics, and M–the locking spacer. Careful assembly of these parts is vital for correct alignment. However good the materials used, the tiniest discrepancies in assembly can seriously reduce lens quality and the reliability of the mechanisms*

A high-quality lens can withstand the most alarming abuse, because the elements are mounted strongly. Cheaper lenses can have their elements decentred after a hard knock. If you have a cheap lens giving superb definition, guard it carefully.

The separation of the elements is another parameter that can be skimped. Frequently, the accuracy of separation of individual elements is better than 0.025 mm; tolerances half as good are not unknown. A poorly finished mount might have burrs, which prevent correct seating (or, equally likely, pack the element so that it seats correctly).

Throughout assembly, extensive testing is essential. This accounts for the high price of the best lenses: effectively, they are tested individually. Perhaps the most impressive testing procedures are operated by Linhof, who take first-class lenses from Zeiss, Schneider, and Rodenstock and then test them again—and still manage to reject some. No matter how good the lens, some are bound to be better than others—but a Linhof selected lens is usually unbelievably good. Most other selected lenses are simply very good.

Creative approach

Farms

Photography on the farm does not just mean landscapes and animals—still lifes, portraits, abstracts, almost any kind of shot can be found in this varied and lively environment

From the picturesque charm of dark figures stooping in golden fields during a Cretan summer harvest, to the overwhelming power and sophistication of a modern combine harvester carving its way across the Prairies, farms and farming provide tremendously varied subject matter for any photographer.

Generally speaking, farms have the advantage of being relatively accessible places for photography. Much can be photographed from a country road or from footpaths cutting across fields. In many parts of the world, farms or ranches are so large that they have no enclosed borders and travellers can move freely through the territory. Often people have friends or relatives living on farms, while a farmhouse holiday also allows a close view of what goes on and provides the time needed to get to know the surroundings and the working conditions. A prolonged visit to a farm also allows the photographer to gain the confidence of the people involved so that they can go about their work unselfconsciously without worrying about being photographed.

Most of the photographs that can be taken of farmland from a distance—whether from a hillside, a country road or a footpath, tend to fall more into the category of rural landscapes (see page 329). However, staying on a farm and being closely involved can be very helpful for yielding very striking

Chickens *In misty weather, the soft lighting and pastel colours create a natural atmosphere ideal for a reflective, peaceful shot*

Adam Woolfitt/Susan Griggs Agency
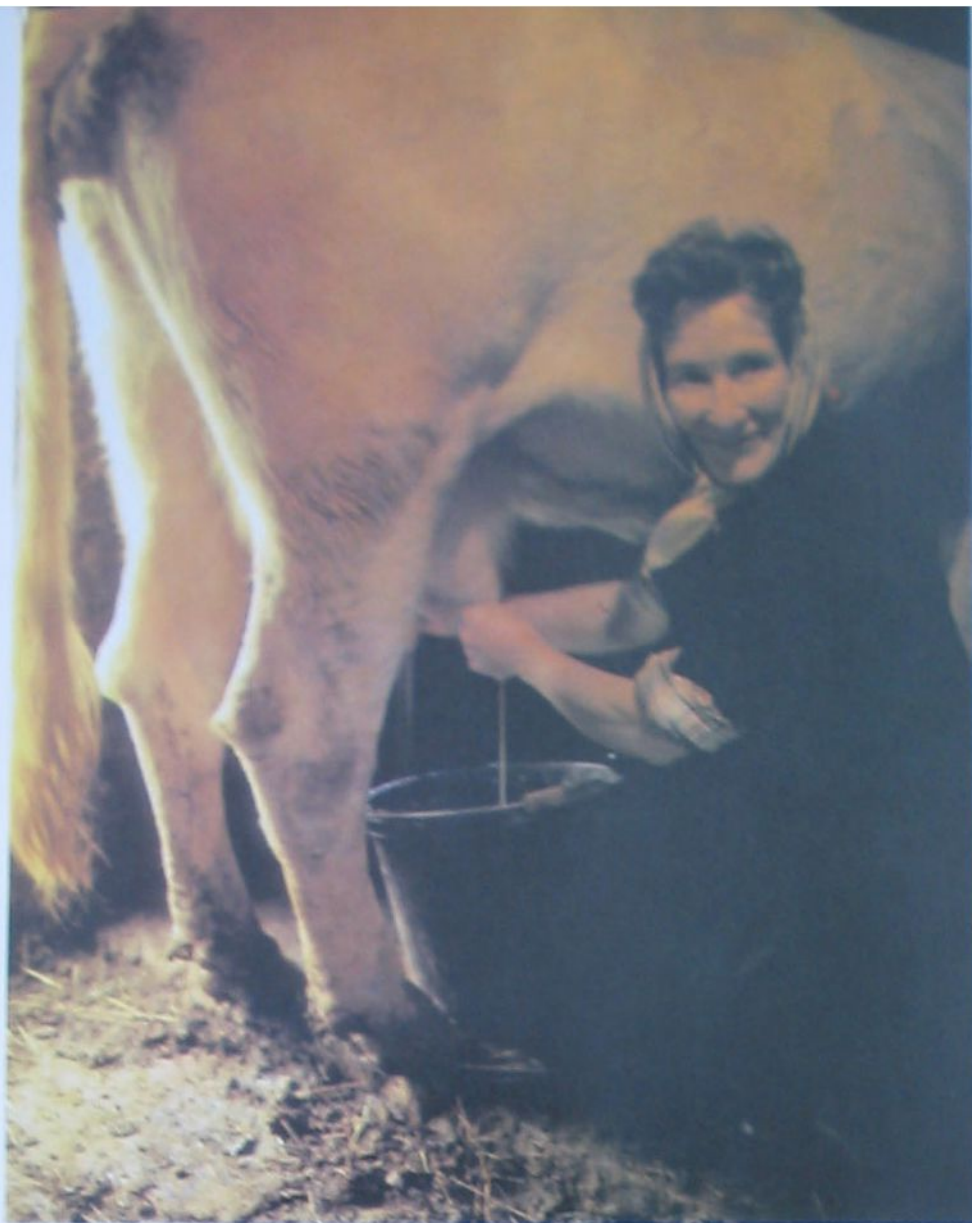
photographs. Beginning with the dawn, you can shoot highly atmospheric images of the work day. It is well worth getting up this early for the light alone—a pale misty dawn brightening into a colourful sunrise—but it is also the time when you see the first signs of life around the farm. The lights coming on in the farmhouse with a background of deep blue dawn sky could be your first shot. Of course this means getting up very early and getting to a good viewpoint so that you can set up your tripod at a spot which offers a good view of the house, but which also allows you to photograph it as part of the farm.

With the sunrise—or even before—comes the first sign of the long day's work. Plan your day so that you can follow this work through its course. By knowing the routine and planning viewpoints carefully you can be in the right place to photograph the first workers and machinery moving off towards the fields. There is rarely a shortage of activity at this time in the morning so you have to decide which of the chores are likely to be most successful for photography. This largely depends upon the location—cows being rounded up for milking or sheep being moved off to graze are potential subjects if the surroundings look attractive. With fast film or with flash you may also be able to get successful indoor shots at this time—cows being milked or eggs being collected.

Milking *Try to shoot by natural light with indoor subjects since the harshness of flash tends to destroy the mood*
Burning the stubble *Blazing stubble looks dramatic but usually only photographs well once the sun has begun to sink*

Tapdance

Fireside chair *In and around farmhouses, especially older ones, there are many subjects for still lifes. Exposures indoors may be difficult, so bracket carefully*

Butter *Getting the farmer to hold his butter, so that the muscles in his arms stand out, and also moving in with a wide angle helps to bring out the fullness of the butter round*

George Wright
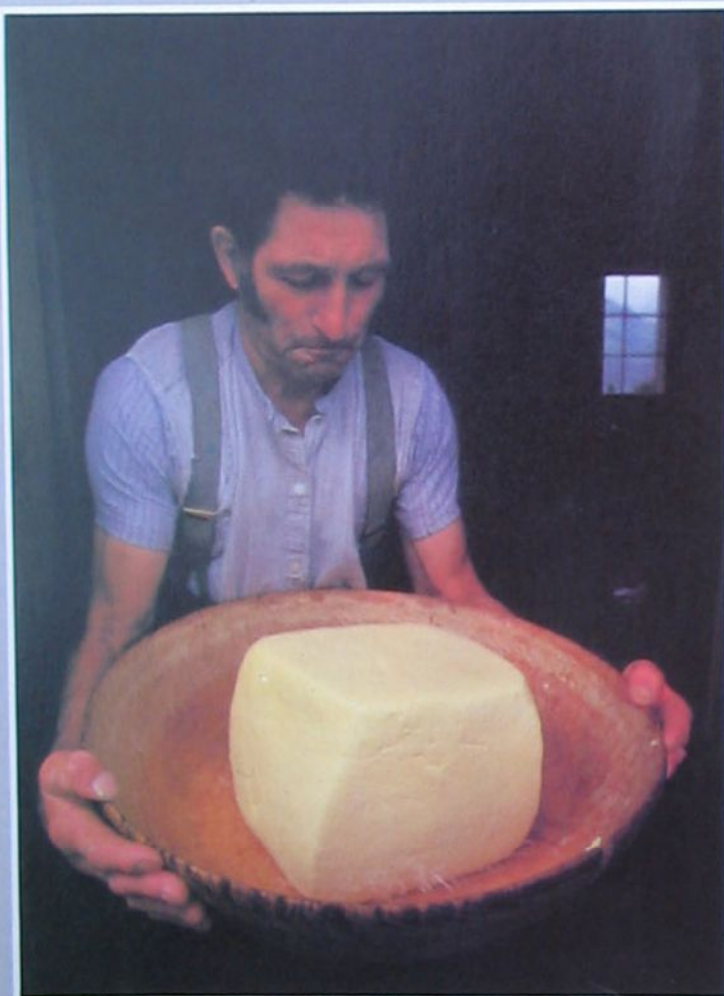
Gulls The kind of photographs you can take depends largely on the time of year. This shot was clearly taken during the ploughing season—the wheeling birds make the shot

Prize pig Most farmers will be only too pleased to pose for shots with their finest produce. Sending a copy or two returns the favour and may make you a friend

Cow Straight record shots of farm animals are invariably uninteresting so look for a new approach, such as moving in close with a wide angle

John Sims

governed only by what actually happens in the place you are visiting. Certain features of farm work and farm life have particular photographic appeal throughout the world. Think of a tractor ploughing a field or sowing a crop while being surrounded by hundreds of birds —or perhaps a huge combine harvester lumbering across ripened fields of wheat with the golden dust of crushed grain hanging in a cloud above it. These are both examples of subjects that can be highly photogenic, whether shooting from the edge of a field with a long telephoto or actually sitting on the machine and using a wide angle. Shots like this are particularly dramatic in wide open 'Big Sky' country, especially if there are colourful grain elevators in the background.

Always a dramatic time on the farm is when animals are giving birth. When a cow or horse is about to produce a calf or foal the scene is clearly tense, a vet may be called, and the anxious farmer and his cowman will be there together, perhaps with the family. Inevitably, these events occur at night—this should not deter you—and if there is room a long exposure using the light available in the cowshed (with tungsten film to match the tungsten electric lights) will produce a very low lit gentle moment as the mother gives birth. Follow up shots can show the new baby's progress.

If the photographer has access to the farm all year round a 'year in the life of the establishment' can be a very valuable creative documentary. This portfolio of the seasons can be shot from a single marked spot—the same picture, in fact, but with an ever changing environment.

Most farms are both a home for the farmer's family and his place of work. A

Ploughing *The rich golden light resulting from shooting into a setting sun gives a nostalgic feel to this shot of a disappearing aspect of farming*

A low level shot showing the light catching the uneven cobble or paved stones can be an attractive way to photograph a cowshed, especially if the floor has been hosed down. Inside the cow-shed milking by hand still takes place on smaller establishments and with careful attention to lighting— perhaps with soft fill-in flash you can produce an atmospheric photograph that captures one of the oldest farming chores.

If you shoot by available light, be sure that it strikes the important areas, particularly the face and hands of the

person milking. Fairly fast film helps cope with low light levels but also has a softening effect on the scene.

In contrast, with highly technological milking scenes the reverse would be true—artificial light can be combined with slow fine grain film and an FL/D filter to show the aluminium and chrome plated, maximum hygiene, well-scrubbed modern dairy building.

The obvious way to follow on from this early start is to document the activites which continue throughout the day. There is alway work to be done on a farm so the choice of subject matter is

Tractor *Take full advantage of times when the sun breaks through dark cloud—the colours of the countryside are never more intense*

Flock *Shooting into the light and framing tightly, the photographer has registered this flock of sheep as a semi-abstract pattern*

John Bulmer/Susan Griggs Agency

dramatic. The razor sharp blades of a plough can be shown in close-up shots as being quite abstract and surreal. Coming in close to a bright red or yellow section of combine harvester shot against the wooden or stone wall of a barn will have a similar strong effect.

A recent innovation which opens up new possibilities for the city dweller is the city farm. Hidden away in the backstreets of cities' run-down areas, they offer local children perhaps the only chance they have to meet animals which they see only in books. Look in particular for these children's reactions when introduced to sheep, goats and cows for the first time. You will see an excitement and an enthusiasm rarely seen in the countryside where animals are entirely familiar. Delightful candids should be easy to get as you will probably be completely ignored.

Try also for shots illustrating the paradoxical nature of the farm's location, perhaps taking shots on the farm to contrast with another taken from a distance, showing the farm dwarfed by the flyover. A slow exposure could emphasize the difference in the pace of life, with animals feeding quietly as lorries thunder past in a blur.

strong set of pictures can result if you concentrate upon this aspect. In the winter, interior shots will show the comforting log fire heating family members after working their long day in the fields. All the generations of the family can be documented, showing the various roles they play in the running of the place.

Your shots could show the farmhouse's living space and comforts, and its warmth will contrast sharply with the surrounding service buildings—barns, shelters for animals, crop storage and working arrangements for animals, crops and produce. The pattern of the daily routine can be followed by joining a farm worker from dawn until dusk—by using the changing light from a soft pastel sunrise through the day until the 'red sky at night' you can show photographically the progress of the countryman's day.

The habits and customs of the local people in relation to the farm can be followed in a similar manner. If there is time, local fairs and fetes with their local customs can be used to give an insight into the farming community.

Back on the farm the photographic possibilities are endless. The strong contrast between the centuries old original local stone buildings and the primary colours of the vehicles of modern technology will be very

Cart wheel *The subtle textures and colours of old farm machinery can make attractive shots—particularly if you include a few of the locals*

H. Veiller/Explorer
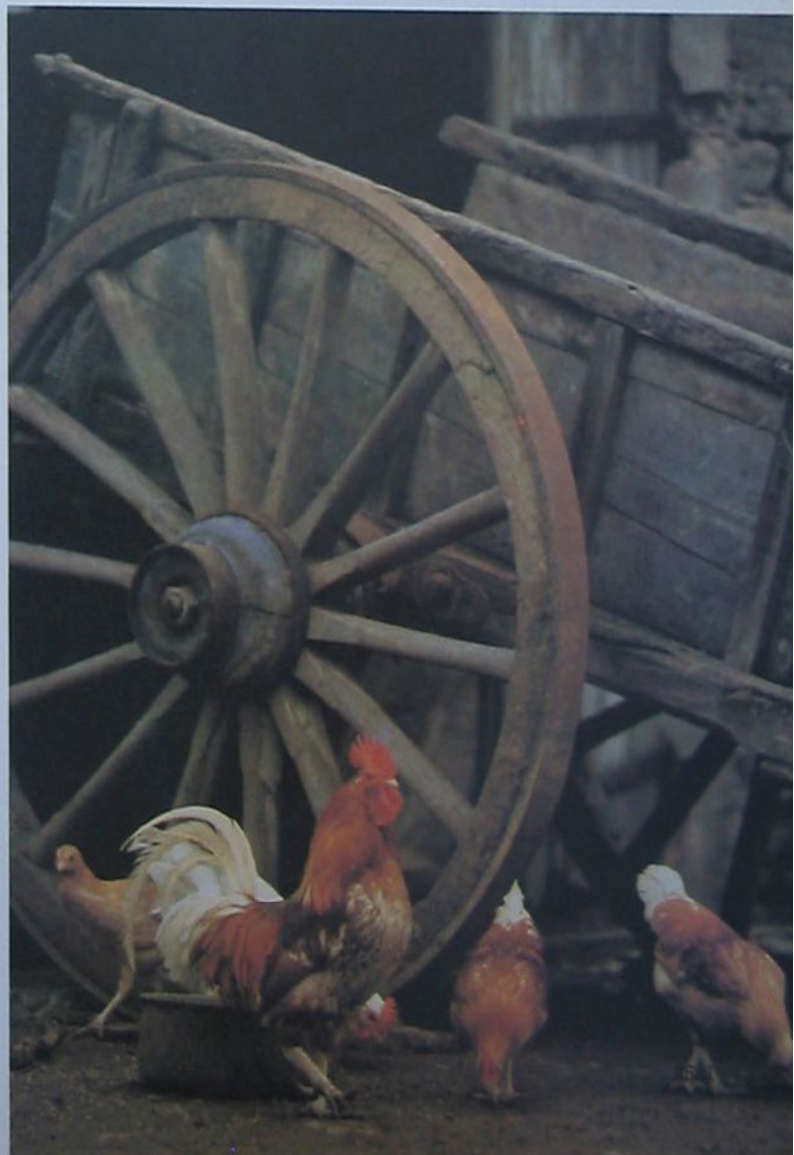
Precision exposures -2

For the best possible exposures with b & w film, the 'zone' system is unbeatable. Though the full system is difficult to set up, there is a simpler version which still gives superb results

Of all the techniques for metering and exposure, the zone system is the most advanced—and the most complicated. Originally developed by Ansel Adams in the 1940s, it is intended mainly for black and white work, and involves preliminary darkroom work to set up the system. But once you have mastered the system, you will find that your understanding of exposure and your control of tones is much better.

The system is based on a scale of fixed tones—or *zones*—each of which is given a number (see box). By relating zones in the subject to tones which will appear in the final print, and relating both to an exposure meter reading, it is possible to finely control the range of tones in your pictures, and so get the most out of the materials. To enable you to do this,

however, the processing and printing procedures must be standardized. And even the film speed may have to be altered to suit your own set-up and equipment.

First steps

Start in the darkroom to see what information a normally developed negative produces. Mark on the enlarger column a height for the enlarger which produces a convenient print size. Marking it allows you to repeat the test accurately, though you should also make extensive notes of everything that you do.

Having chosen a convenient aperture —say f/8—make a test strip using the unexposed edge of a negative or, better still, an unexposed frame. This means

Fine print By using the zone system with large format film, Ansel Adams achieved superb quality in his prints

that the density of the negative is just base density plus fog. It is important, though, that the film stock and development are strictly standardized.

Make the test on grade two or three paper (whichever you use, you should use the same grade for all future prints). Give several exposures, increasing by two seconds each time, and develop fully. When dry, examine the result under a bright light. If the exposure is about right, at some point the tone steps become dense black and indistinguishable from each other. This is the deepest black of which your system is capable— zone 0. The exposure time for the first of

these dense black tones is your standard printing or *standard negative exposure time*. Depending on the enlargement and your equipment it will be about ten seconds.

Having found the standard print time, you must now determine the correct film speed to use with your system, and this is done by producing a mid grey print. In effect, this calibrates your exposure meter and camera.

Set up a sheet of plain white or grey card under even illumination. Out of doors on an overcast day is ideal, provided the light level is constant. Take a reading with your usual meter at the film manufacturer's speed rating, making sure that the meter reads from the card only. Move in close if necessary, but try to standardize your procedure so that you can repeat it.

The meter will suggest an exposure which would make the card mid grey in the print, which is precisely what you want. Take a number of shots of the card at different exposures—about two stops either side of the metered reading, in half stop increments, should be sufficient. Try to keep the shutter speed constant—though it may be worth running the test several times with different shutter speeds as a check for any inaccuracies in the camera. Develop and fix using your standard procedure.

Now print the resulting negatives at the previously determined standard printing time. Compare the prints with an 18 per cent grey card and find the one which comes closest in tone. Providing you know which negative this print is made from and what exposure it had, you can determine your personal film speed, relevant to your equipment and processing. For example, if the nearest print came from the negative which was given double the metered exposure, then the true film speed should be one stop less than the recommended rating —say 64 ASA (ISO) in place of 125 ASA. This sort of adjustment is quite common with black and white film (though not so usual with colour).

At this point it is useful to make a *zone ruler*. This is a scale which shows you what the zones look like with your usual printing paper. Making such a scale involves shooting the grey card again. This time the first exposure should give four or five stops underexposure, to give zone 0 or 1 (in 35 mm photography zones 0 and 1 tend to merge due to the limited tonal range of most films). Make nine or ten exposures, giving one stop extra exposure each time. Once again it is best if you can keep the exposure time standard—preferably around 1/60 second, but in any case less than one second to avoid reciprocity failure.

Develop and print as for the other tests. The result is a series of prints from deepest black to pure white demonstrating the full range of tones. Trimmed neatly, these can serve as a reminder of the tones your equipment will produce. Of particular interest are the differences visible between zones 1, 2 and 3, and

Making a zone ruler

1 *Use a blank frame on a normally developed film. This gives you the minimum density (film base plus fog) which you will encounter in your negatives*

2 *Make a series of test prints, noting the exposure time for each. Your standard exposure time is that which produces the first maximum black*

3 *Next, take pictures of a standard grey card at the exposure suggested by a meter and bracketed exposures, marking in the frame the compensation given*

4 *Using the standard printing time, make a set of prints and find the one closest to the grey card. This shows any necessary changes to the film speed rating*
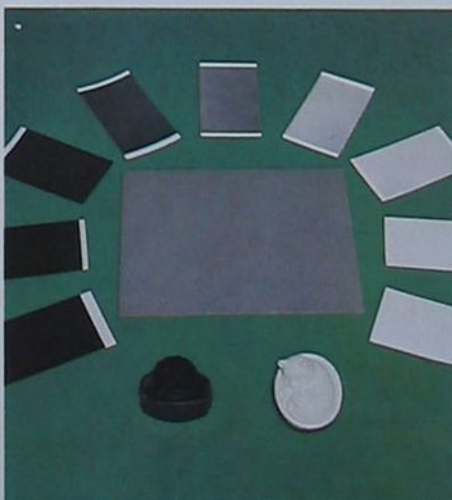
5 *Using bracketed exposures in the camera and the grey card as the subject you can make a set of prints from white to black at one stop intervals—the zone ruler*

6 *Use the zone ruler to decide what tone you want an object to be. Then meter the object and use the index mark on the dial corresponding to that zone*

John Mathers

zone	0	I	II	III	IV	V	VI	VII	VIII	IX
units of light	0	1	2	4	8	16	32	64	128	256

Note: rendering of sky here is between zones V and VI, achieved with a yellow filter

zones 7, 8 and 9.

All of this assumes normal development in fresh developer. Even so, it sometimes happens that the zone ruler is not quite right. You might find, for example, that although zone 5 is a reasonably good match to the grey card and zone 0 (or 1) is a good deep black, zone 9 may not be pure white. This implies that the development should be increased slightly to produce a denser negative result for the highlights. This slightly alters the density of zone 5, but hardly changes the darkest zones at all.

Whenever you have a few frames left over at the end of a roll of film, use them to experiment. Try over- and under-developing by various percentages and see what the effect is on another zone ruler series. Determine what development times enable you to keep zone 0 black, but move the higher zones up or down the brightness scale by one zone or more. Having done this, you can apply the results in the field—for example, when you need lower contrast with contrasty subjects.

Using this method to control contrast is much more accurate and predictable than any other technique—certainly much better than just guessing, which is what many photographers do. These procedures may seem complicated, but they are an important foundation, allowing you to predict what the result will be when you make the actual camera exposure.

Using the system
Compared with setting it up, using the zone system is fairly simple. You must be well acquainted with the print zones, and it is a good idea to carry the zone ruler with you, especially when you first use the system.

2524

Zones and tones

The zone system divides the intensities of the objects in any scene into a number of bands, or *zones*, each double the brightness of the previous zone. The zones are numbered from 0 to 9 as follows:

Shadows

0　The deepest black of which the paper is capable
1　The darkest tone distinguishable from black, but without texture visible
3　Adequate texture in dark materials

Middle greys

4　Dark mid tones, such as dark leaves or shadows in portraits
5　Standard middle grey—18 per cent reflectance. Clear blue north sky
6　Light mid tone. Average white skin in sunlight or shadows in snow

Highlights

7　Very light areas, but with texture clearly visible
8　Almost white, with very little or no texture. Brightest reflections in face
9　Pure paper base white with no detail. Snow in sunlight and bright reflections in, for example, chrome

This scale represents a tonal range of 512:1 for the negative, which is reduced to about 50:1 in the print. It is possible to adapt the zone system for use with colour transparency film, but you will find it necessary to use a different set of zones. Transparency film records a tonal range of only five stops, so the zones above should be grouped in pairs (0 combined with 1, 2 with 3, and so on). You should also use a more limited range of index marks on the meter (see page 2479).

The best approach is to use a meter which has a range of exposure index marks, such as the Weston (see page 2479). These marks represent zones 1 to 8. The absence of marks for zones 0 and 9 is not a problem as these zones are simply pure black and pure white, and will rarely need to be metered for. In any case, with 35 mm photography, zones 0 and 1 often merge, as do zones 8 and 9.

The basic metering method is to first decide what zone you want a particular object tone to appear in. Say, for example, you want a flower to reproduce as zone 3. You should meter from the flower going very close if necessary to avoid metering other objects as well. Then use the mark corresponding to zone 3 as your exposure index.

The other object tones will arrange themselves according to their brightnesses relative to the flower. But you may find that the range of brightnesses is too great, or that you lose detail in another important object.

It is worth, therefore, taking readings from the brightest and darkest objects in which you want detail to appear. If both of these fall outside the normal range of zones you should either reduce development to compress the tonal range, or be prepared to sacrifice detail.

Alternatively, you may find that the range of zones is not very great. The brightness range might only be from 2 to

6, for example. In this case you could increase development slightly. But whenever you alter development, it should always be done according to previously made tests.

Another problem is that the zones might go off the scale at just one end. Putting the flower on zone three may only give you a range of zones from 0 to 5. In this case it may be wise to change the flower to zone 4 or 4½. On the other hand,

such a limited tonal range is not always a problem, particularly if you actually want a low key picture (high key shots are obtained in a similar way). Although it may seem tempting to compensate for contrast problems by using different paper grades, the point of the zone system is to get the best possible negative, so that such compromises do not have to be made. Only this way can you get perfect exposures.

Using the zone system with flash

The zone system can help predict how fill-in flash will operate. Consider trying to photograph a person while the light is harsh. The meter indicates a difference of three stops between the highlight and shadow details. If the brighter parts of the face are placed on zone VI as they should be, the shadows will fall on zone III—almost featureless. If a flash gun is used to add light to the shadows a simple diagram can be drawn to show what will happen. A flash gun at normal power will give 16 units of light contribution to the scene—in other words a zone V amount.

zone No.	I	II	III	IV	V	VI	VII
equivalent units of light	1	2	4	8	16	32	64
metered subject add flash, 16 units			shadow 16			highlight 16	
Total resulting			20			48	

The facial highlights are now at 48 units, about zone VI½ whereas the shadows have moved up on zone V½. The overall exposure could be cut ½ stop to place highlights in zone VI.

Just over a stop difference between highlight and shadows may be thought too little (too much fill in) so draw another diagram to find out what will happen if a half power flash is applied. Half power equals 8 units of light.

zone No.	I	II	III	IV	V	VI
units of light	1	2	4	8	16	32	64
metered subject add flash, 8 units			shadow 8			highlight 8
Total resulting			12			40

The difference between the two is just under two zones, about correct, and the added light would not require a decrease in exposure as between 32 and 40 units is only a quarter stop

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Ansel Adams

Ansel Adams (right) is the father of the zone system. Using this system enables him to produce pictures with stunning tonal ranges which, when combined with his undoubted creative talents, result in prints with great intensity and power. Original Adams prints are among the most expensive on the market, some fetching as much as a luxury car.

To get the utmost quality from his b & w film he uses large format cameras, usually 5 × 4 and 10 × 8 inch. But his introduction to photography was much less auspicious.

It was in 1916, at the age of 14, that he first took up photography. His imagination was fired by the great vistas of the Yosemite Valley in California, and he attempted to record these using a box Brownie. He studied photography assiduously and quickly mastered the basic techniques. By the mid 1930s he had made his mark as a leading American photographer, highlighted by a one man exhibition at Alfred Stieglitz's gallery, *An American Place*.

The main influence on Adams was Paul Strand, and he collaborated with people like Edward Weston, who all shared a love of the 'fine print'. Two of his most important photographs—*Banner Peak* (1923) and *The Half Dome* (1926)—were steps on the way to realizing that the photographic medium is a craft which needs to be carefully controlled and understood. To this end he developed the zone system—a method which demands that the photographer be aware of the precise effects of exposure and development.

The zone system has been known to inspire

Mimi Jacobs

almost fanatical devotion in some of its most ardent followers, who tend to rate technical quality above aspects such as interesting subject matter, or good composition. Nevertheless the Zone system remains, forty years on, the standard technique for ultimate print quality.

Silver recovery

At one time, silver recovery was only possible for manufacturers and large processing houses. But today, even amateurs who process their own films can reclaim the silver that would otherwise be washed down the drain

Photography depends on one of the world's precious commodities—silver. So it makes sense to conserve this silver, and to recover it from photographic processes wherever possible. Although the amount of silver in, say, a 36 exposure black and white film is not particularly great, and accounts for only a small proportion of the cost of the film, over a period of time the amount of silver that a serious photographer uses up is considerable. A single sheet of A4 paper, for example, has virtually the same emulsion area as a film. And in the case of colour processing, virtually all the silver originally in the film or paper is replaced by dyes during processing.

Furthermore, much of this silver is often thrown away.

The job of the fixer is to remove unwanted silver salts from the clear areas of the image, so the silver content of used fixer can be high. Sometimes it actually precipitates out, forming a black sludge—silver is only shiny if it is polished. The increasing silver content of normal fixer slows down the fixing action until eventually it does not go to completion however long it remains in the bath.

A fixing bath used for prints should not contain more than about 1.7 g/litre of silver. In the case of film fixer, about 3.5 g/litre is the safe limit for small tanks and up to 7 g/litre for large tanks.

The silver content of a fixing bath can be measured using books of yellow paper made up like the litmus papers familiar at school. A slip of paper dipped briefly in the bath and shaken to remove excess liquid turns from yellow to brown—the depth of the brown colour is a measure of the silver content. A chart, supplied with the estimating papers, has a scale of brown tones with which the test strip can be compared and the silver content read off in g/litre or ounces per gallon. There are also plastic test strips for evaluating the silver content and acidity of a fixing bath.

The amateur normally throws spent fixer away and test papers are useful for making sure that they are used to their maximum capacity. As more and more amateurs process their own colour materials, devices have become available which extract the silver

Bullion *Each of these 1000 ounce bars contains enough silver to make over 100,000 colour negative films*

slowly and on a small scale. It is no longer necessary, therefore, to save fixer until there is a large enough quantity for silver recovery. But there are various ways of recovering silver, not all of which are suitable for use at home.

Metal exchange

If a piece of clean copper is placed in a well used fixer, pure silver is plated out on it, the silver salts in the fixer being replaced by copper salts. This is an amusing method of transforming coppery coins into silvery ones, but the plated coating is very thin and will get no

Silver Grabber *This mains powered unit collects silver by electrolysis. Once silver has collected on the plate it can be removed by flexing the plate so that silver flakes fall off*

thicker no matter how long you leave the coin in the fixer. A more worthwhile method of recovering silver is therefore to use a material with a large surface area, such as very fine steel wool.

The spent fixer is filtered slowly through a vessel containing the steel wool, which must be free from grease. All the silver will be removed from the fixer, leaving it charged with iron salts. The fixer must spend a long time in contact with the steel wool, and the silver sludge left on the wool may smell badly, so this technique is not very convenient. The silver plated steel wool is sent to a refiner for reclamation of the silver.

If, say, a 250 litre container of spent fixer can be accumulated over a period, containing perhaps 2 g/litre of silver, this works out to be about 500 g of silver that can be reclaimed. The price of silver fluctuates, but 500 g is worth about half the cost of a typical SLR. So even allowing for the cost of refining, the very active amateur may find silver reclamation worth while, particularly if several people combine their output.

Chemical methods

Silver can be deposited from exhausted fixer in the form of silver sulphide sludge by adding a solution of sodium sulphide. The fixer has to be made alkaline by the addition of sodium hydroxide before this is done. As noxious and toxic fumes are given off this is very much an industrial process and not for home use.

A sludge of metallic silver can be precipitated with sodium dithionite (hydrosulphite), a process which is free from smell but is costly.

Electrolytic silver recovery

Metal exchange or chemical methods cannot be used if it is wished to extend the life of a fixer or to regenerate it for further use. Both large and small scale users of photographic material can now use various electrolytic methods, in which an anode of carbon and a cathode of

stainless steel are immersed in the fixer and a carefully regulated current passed between the two. Pure silver is plated on the cathode. If the current density is too high silver sulphide is formed which makes the bath unsuitable for further use and prevents effective silver plating.

Regenerating a desilvered fixer involves adding fresh concentrated fixer to counteract the losses resulting from carry-over of rinse or stop bath into the fixer and fixer into the wash water. The addition required is that

necessary to bring the specific gravity of the solution back to a specified value. Addition of sodium metabisulphite may also be needed to prevent staining by any developing agents carried over into the fixer which are decomposed at the anode. An efficient stop bath helps to prevent this but it is not generally recommended to use a regenerated fixing bath for prints because of the risk of staining.

Galvanic silver recovery

This is essentially an electrolytic method but it

does not demand an external current source. Two dissimilar metals in contact with each other, such as stainless steel and zinc, are placed in the fixer while it is in use. The silver plates out on the stainless steel from which it can be removed in flakes of high purity. A commercially available unit consists of a metal plate to which are attached metal discs in plastic shells. These have to be changed at intervals as they become inactive after a period of use. This is a suitable recovery method for the small user and it calls for no complicated maintenance. It permits the reuse and regeneration of desilvered fixer, though there is a chance that the silver may be contaminated by zinc when it is removed.

Silver and rapid fixers

The build-up of silver in ammonium thiosulphate based rapid fixers does not slow down the rate of fixation and much higher silver levels can be tolerated—up to 5 g/litre for prints and as much as 10 g/litre for films. Desilvering such a fixer does not extend its life unless it is regenerated afterwards. The same methods of silver recovery that are used for sodium thiosulphate can be used for ammonium fixers.

There are various devices available; some being mains operated and some requiring small batteries. The units should repay the outlay within a year or two.

Silver Spoon *A self contained battery powers this unit, which must be completely immersed in fixer. Silver can be scraped off the blade*

Darkroom
COLOUR VISUALS

Simple and easy to use, two graphics arts films— Color-Key and Image and Transfer—give bold, brightly coloured images that can be graphic indeed

Color-Key is designed primarily for graphic arts reproduction, but it is very simple to use and its bright, strident colours make it an attractive way of making pictures from all kinds of original. A single Color-Key film will only give one colour, but by combining films, you can produce multi-coloured images.

Images can be produced from any original providing it is translucent. At one extreme you could try making photograms of glass-like objects, leaves, fabrics and textured screens. At the other, simply use normal black and white continuous tone or lith negatives for bold, stark abstracts. In the graphics field, it is easy to produce coloured images from tracings, pencil drawings and dry transfer work. The result in all cases is a line image in the film colour you have chosen.

Images on the transparency film can be mounted on plain or patterned white or coloured backing material, such as card or metallic foil—just like ordinary lith film can be. Two or more transparency films can be bound together to form a multi-coloured image which can be used either as a slide for viewing or projection—or as a negative if you wish to continue printing and derivation work.

As Color-Key can be handled safely in
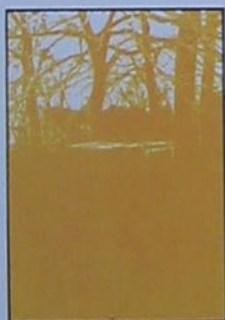
Pick 'n mix Color-Key films in several colours can be combined to form a colourful image. Images a, b, c, d, e and f were used for the picture above. Images c, e, f and g were combined with a lith original for the picture on the right

Tree *A lith film image forms the basis of both these bas-reliefs, which show the colourful potential of Color-Key even when backed by ordinary white card*

low light, it offers further intriguing possibilities when used in place of traditional tripack film materials in many derivation processes. For example, a set of tone or colour separations on lith or continuous tone material could be contact printed on the appropriate Color-Key films to produce interesting colour posterizations when the individual films are combined. The same Color-Key films could also be set out of register for a bas-relief effect. In each case, the combination could be copied using a camera or enlarger arrangement —or, conventionally, contact printed on direct reversal print or film material. In this way, each component of the image may be rescued.

Color-Key films are available in a range of over 30 different individual colours, either as negative-acting 'transparency'—clear-based after development—or as 'opaque' (nine colours only). Positive-acting transparency film is also available in nine colours. The standard size of Color-Key sheets is 254 × 303 mm but some are available in sizes up to 606 × 960 mm. A pack of five sheets in the standard size costs much the same as three 20-exposure Kodachrome films. A rainbow pack of 25 sheets costs about the same as ten rolls.

Using Color-Key
As the emulsion used in the Color-Key film is too slow for normal enlarging, contact printing methods are used. So the first stage is to prepare these originals for printing. Use high contrast originals such as those made on lith film to help along the high contrast effect you obtain using Color-Key.

You need a negative original to obtain positives when using negative-acting Color-Key film, and a positive to obtain a positive image with positive-acting film.

However, you can bypass the need for positive-acting Color-Key by either producing an original which is a negative—easily made by enlarging a slide—or simply going through an intermediate stage to print a slide on orange Color-Key and then use this as the original negative.

All the assembly and preparation stages for printing can easily be carried out in subdued room lighting—but work away from windows and bright light, work under orange safelighting.

You can use an ordinary contact printer—or a simple home-made arrangement. Place the dull emulsion side of the Color-Key film down against black card backed with a sponge mat. Smooth the original image into close contact with the shiny side of the film, using a lint-free, antistatic cloth or the side of your hand. Weigh down the sandwich with a sheet of clean glass.

Exposures are made using any ultra-

Using Color-Key

1 *Use full-size negative or positive originals suitable for contact printing. You can use a UV lamp or movielight or bright daylight to make the exposure*

2 *The special exposure unit available as a component of the Color-Key system is especially useful for consistent results and short exposure times*
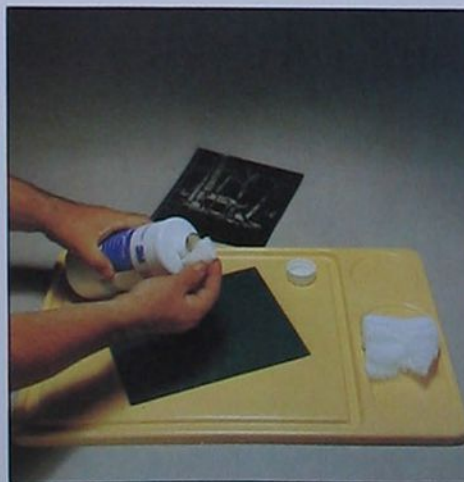
3 *Place the film emulsion upwards on a flat tray (such as this one, which comes with the complete outfit). Soak a fresh ball of cottonwool with the developer*

4 *Firmly but carefully swab the entire emulsion area with developer and continue rubbing gently until the unexposed parts have been removed*

violet-rich light source. The most convenient method is to use a UV lamp or quartz halogen movielight—with appropriate safeguards. Exposure times will depend on lamp power and the distance the lamp is held above the contact printing set-up. You can use bright sunlight but make sure the printing set-up is firmly clamped to a carrying board, so the original cannot slip in relation to the film. Simply place the board on a sunlit windowsill—or outside—for two or three minutes. Experiment to find the ideal time whatever exposure method is most convenient.

A special 'lightbox' desk top exposure unit can be bought as a component of the Color-Key system. Because it is a precisely controllable form of UV illumination, it can be very useful if you plan to do much Color-Key work—or other darkroom work which relies on UV for exposure, such as old printing processes.

Parts of the Color-Key image which receive sufficient exposure resist removal in the ensuing 'development'.

Place the exposed film with its emulsion face up on a shallow, level bottomed plastic tray. Pour a little of the special Color-Key developer (available in litre bottles) on to a cotton wool swab or buckle brush and wipe the film. Use light, even pressure to remove all the surplus colour—but take care not to scratch the delicate emulsion which remains. Then rinse the film with water to clear the film—a second tray would be useful here. Start by hosing down the emulsion side, then flop the film and rinse the shiny side. Keep the water at about room temperature. Empty the tray and, after using a flat bladed squeegee to wipe down the shiny side, lift the film out carefully by its edges and place it on a sheet of photo blotting paper. Do not squeegee the emulsion side—simply blot it and leave the film to dry.

John Ward

5 *Transfer the film to a rinse bath of cool water, wiping carefully with a fresh ball of cottonwool. A sheet of glass forms a useful smooth work base*

6 *Flip the film over on the glass and remove the two from the rinse. Mop or squeegee the shiny side dry, flip the film and carefully blot the emulsion side*

7 *Compare the result with the original and decide, on the basis of the amount of detail which has been removed, whether a different exposure is needed*
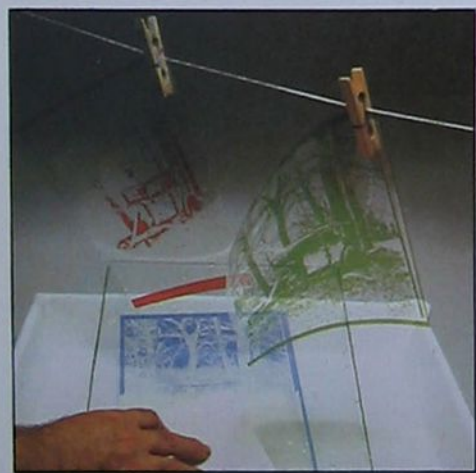
8 *Then proceed to expose other colours which may be needed for a combination. These can be made from other originals— or from the same one used initially*

9 *Check out the combinations on a lightbox before taping films together ready either for copying or for display. Other possibilities may become apparent*
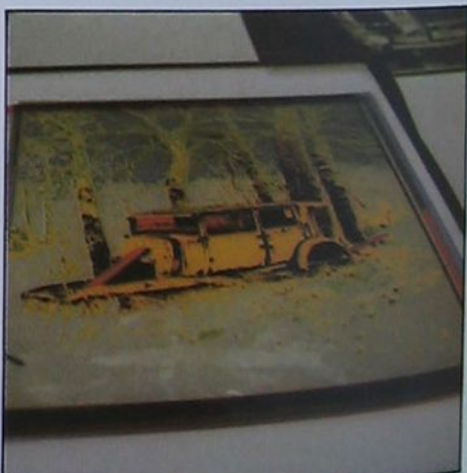
10 *Here is another variation, produced by combining a blue sky image with green and red details. All images come from a 6 × 7 transparency original*

Tim Stephens

Daisies *Negative and positive high contrast originals were contact printed on the same sheet of Color-Key, and the resulting images combined to form this bas-relief slide*

When the film has dried—this does not take long—check the image on a lightbox. See if the required fine detail has been retained—if not, increase exposure next time. If the film colour image is largely removed, greatly increase the exposure and—in reallly severe cases—adjust either the method or the means of making the exposure. If unwanted parts of the image cannot be removed during development, reduce exposure substantially. But it is worth checking that the film has not been exposed to bright light during storage.

Different colour positives enable you to experiment quickly and inexpensively with different colour overlays. With reverse-outs or *tone drops* you can add colour within colour as well as superimposing those in a straightforward overlay.

For another variation, try using negatives of different density made from the same original. Print a different Color-Key for each and superimpose these to obtain a colour posterization effect.

For really elaborate multicolour work, start with a black and white line original and selectively mask off various areas as you print off each colour.

The combination can then be copied—or simply mounted on white or coloured card or foil as a finished image.

As the Color-Key film is extremely thin, you can easily print from any sandwich. But take care to keep such a stack of Color-Keys free of dust and hairs. Interesting effects can be obtained by switching the stacking order of Color-Key used in this way.

Using opaque Color-Key follows exactly the same exposure and developing routines. Special colourants can be used to enhance the monochromatic line image which cannot effectively be combined with other opaque films.

Making your own dry transfer

1 *Image and Transfer material (INT) is exposed like Color-Key but exposure tests should be made first for each new pack of this more expensive material*

2 *Expose a small strip of INT in contact with a step wedge. For processing, peel off the protective liner to reveal the peach coating and soak this in a pool of water*
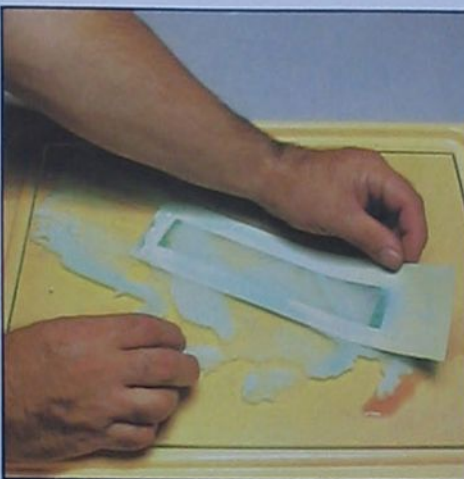
3 *Leave the INT to soak for 10 to 15 seconds then wipe away the dissolved peach coating. Then spread on INT developer to reveal the test image*

4 *On the basis of your test, expose the main image and process as before. Let the developer set for 20 secs, then use both an up-and-down and side-to-side zigzag wipe*
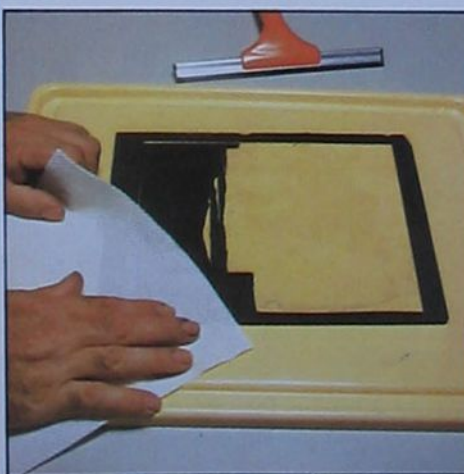
5 *Rinse both sides of the sheet with cool water and lightly squeegee the uncoated side. Flip the film and then blot the coated side before leaving it to air dry*

6 *Store the finished sheet with the coated side in contact with the green sheet that is provided. Poor tack indicates that the exposure is either too short or too long*
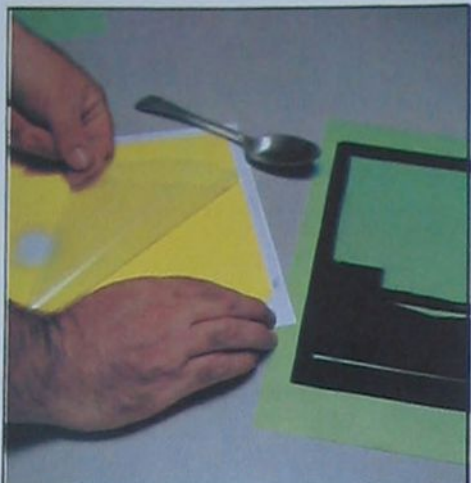
7 *The INT dry transfers can be rubbed down on to almost any type of surface. You can build up coloured images but take care to get the order right*

8 *Use a blunt stylus or spoon and rub until the image appears to become slightly grey. As you slowly peel the carrier sheet away, check the image transfer*
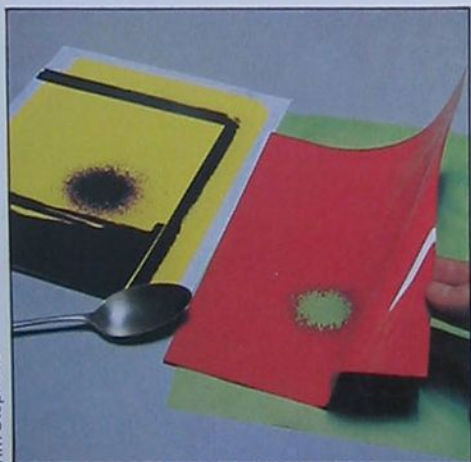
9 *Interesting and colourful effects are possible by rubbing down INT transfers on to both sides of a transparent material such as acrylic sheet*

Pauline Gentry

Colour transfer *Like Color-Key, INT gives a strongly coloured graphical quality to photo originals—but it can be rubbed on to almost any surface*

Image and Transfer

A related product, called Image and Transfer (INT) enables you to make your own dye transfer sheets from almost any form of translucent original. You can make photograms as well as using photographic and artwork originals for more usual applications. The resulting dry transfers can be rubbed down on to most types of surface including glass, vinyl, wood, metal foil and acetate as well as ordinary paper and board.

INT material is available in black, white, blue, green, red and yellow in boxes of ten sheets 280 × 356 mm. A litre bottle of INT developer is needed. Also available are developing pads, a developing kit and a sensitivity guide, which is a grey scale to help you determine the correct exposure time.

To use INT, simply prepare a line negative from your original or make an intermediate orange Color-Key negative by contact. Then contact print a sheet of INT material, exposing in exactly the same way as Color-Key.

Carefully remove the protective liner from the back of the INT sheet—this exposes the emulsion ready for development. Place the sheet emulsion up in a flat bottomed tray, pour developer over it and gently wipe the film until an image appears. Rinse the film and blot it dry.

The sheet is subsequently used just like any other sheet of dry transfer material—placed in contact with the lay-down surface and burnished into place. Carefully peel away the backing to leave the transfer behind. Dry transfer images can be combined either with others you have made, or with commercially available ones. To prevent 'picking', make sure the first image is correctly burnished and then use the 'pre-release' technique to add the second. Do this by holding the transfer sheet off the actual work surface while gently rubbing the transfer image to partly release it from the backing sheet. Then press the image into position, burnishing as you do so. Finally, apply special dry transfer lacquer or varnish to protect the dry transfer work from scratches.

Patterns

Patterns can make fascinating images but, as Ian McKinnell suggests, careless composition can rob them of all impact

The urge to make patterns seems to be almost instinctive—look at the way small children experiment with patterns in their paintings or collages, or the way adults doodle when talking on the telephone. Perhaps this is simply a natural extension of man's constant striving to make order out of the chaos that surrounds him, but regardless of its philosophical implications pattern is an important element in many photographs, and pattern alone can often make an interesting subject, as the photographs on this page attempt to show. Of the three I find this the most satisfactory, mainly because of its delightful colouring, but the more I look at it the unhappier I become with it. The main thing that annoys me is that it looks as if the image should be symmetrical, and the fact that it is not would appear to be more of a mistake than a deliberate choice on the photographer's part—the framing appears loose and undisciplined and it distracts from the fascinating patterns of the geometric shapes made by the arms of the umbrella. I would have made the image perfectly symmetrical, with the line that is at present near the centre of the composition exactly in the centre, and the arm that is near the corner of the frame exactly in the corner of the frame, along with its twin on the righthand side. This mirror imaging would then place further emphasis on the shapes the arms make

Buildings offer a good opportunity for searching out patterns, since the nature of their construction demands the constant repetition of basic forms such as windows, columns or roof girders as employed here. But such repetition needs to be handled with care or it will run the danger of becoming monotonous. This is a trap that this picture falls into. Nothing in the composition grabs th eye and prevents it from wandering out of the shot. Regularity such as this demands some kind of break, a focal point within the shot to hold the viewer's eye. There are many ways this shot could have been improved. The photographer could have used a longer lens, closing in on the interesting detail that can be seen on the girders. I would have concentrated on the bottom left hand corner where the pattern is most apparent, or else widened the shot and looked for some detail such as a signal to break up the rather monotonous regularity.

A monotonous pattern rarely makes an interesting shot in itself but it can provide the basic compositional framework which can be exploited by including some conflicting element. For example, a long line of red buses with one green one standing out or a vast array of uniform office block windows with a riotous collection of flowers in one

To an extent this shot illustrates the point made above, that breaks in a pattern are important, for the irregularities on the right of this image draw attention to the more perfectly shaped filigree of the left side. But on the whole this is a very poor photo. It was taken in the same railway station as the shot above, but instead of searching out new patterns, the photographer has simply presented an existing pattern he has found. Thus although the photographer can claim some credit for having found the pattern and recorded it on film, the fact that it is a straight record shot of an existing pattern means that the real credit for the image should perhaps go to the original designer rather than the photographer.

For this shot the photographer used a 400 mm lens, the longest he had, so he cannot justly be criticized for not framing tighter. As the colour adds nothing—the shot is virtually monochrome now—perhaps the shot should have been taken in black and white. This would have offered two advantages. Firstly it would mean that the photographer could have experimented in the darkroom, cropping the shot in different ways to find a more interesting composition. Secondly he could have taken advantage of the contrast control available in b & w printing to either introduce more detail into the background

Creative approach

MODERN BUILDINGS

Much of modern architecture appears on the surface bland and repetitive. Yet there are many exciting modern buildings, and even the less immediately attractive examples provide a challenging and fascinating subject for the creative photographer

At first sight modern buildings may not seem a particularly inspiring subject for photography. What, after all, is interesting about the drab colours and repetitive shapes of so much modern architecture? Yet despite, and indeed largely because of, the simplicity of modern buildings, they can represent a clean canvas, providing much more scope for creative photography than more conventional architecture.

Straightforward record shots of a whole modern building or buildings taken from a distance will rarely result in exciting images. Few examples of

World Trade Centre *Framing the composition with a foreground object is all the more effective if, as here, its form echoes shapes in the main building.*
Curves *By selecting simple elements and framing tightly, you can make a very pleasing composition*

modern architecture are visually interesting enough to justify such an approach. Instead it is necessary to enliven the photo by various means. Shooting at dusk can produce good results, as can night photography. In night shots bear in mind the colour cast which

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those 'white' lights will produce in the final picture. Fluorescent lighting shows up as green while the tungsten or sodium floodlighting which sometimes illuminates the building will produce a rich yellow or orange glow. It is sometimes possible to filter out these casts to a greater or lesser degree but generally speaking you should try to use the colour rather than neutralize it.

Another way to liven up distant shots is to use interesting juxtapositions—for example, shooting from a downtown area with a 1000 mm lens so that the run down Victorian areas are seen dwarfed by their newer and glossier cousins.

Juxtaposition can also be a good technique to bear in mind while shooting from closer to the subject. Rather than try to disguise the bleakness of the endless expanses of concrete and glass, emphasize it by including in the photo a small but brightly coloured foreground object. This should be carefully placed in the overall composition—putting it right in the centre will generally

produce very dull results whereas shifting it to one side or to a bottom corner will help to create a feeling of tension with the vast building pressing down on the detail. Elements as simple as a road sign or lamp post or the top of a brightly coloured bus can be very effective in this approach. As always, simplicity is the rule and it is usually best to make the picture from the two basic elements of the bright detail and the drab block. Close in until all traces of the sky and other potential distractions are removed from the frame.

While small details can help in this way to add impact to a simple abstract, they can also be used to give a different kind of picture. Try, for example, indicating the vast scale of modern buildings by including the people who work in them as a tiny element of the photograph. Photograph an enormous glossy lobby with people milling about. Shoot down the side of a building from an adjoining one and the tiny dots of people walking around outside will give a more

effective indication of scale than the featureless sky which results if you shoot up in the more conventional manner. Even the tiniest image of a person or people will be immediately recognizable, so make them deliberately small to heighten the effect.

Because of the starkness of modern buildings you can play around with all sorts of special effects and unusual angles. Simplicity is essential in these compositions—any excess of detail or other source of distraction will tend to destroy the abstract effect—so search the viewfinder carefully for these distractions before taking a shot. Often this means closing in on the building with a long lens. A zoom lens will be particularly useful for this kind of approach, allowing you to crop tightly and overcoming some of the problems which prevent you from getting to an ideal viewpoint.

Because you are looking for abstraction rather than accuracy you can shoot from many angles—indeed the distortion

Daniel Barbier/Atlas Photos
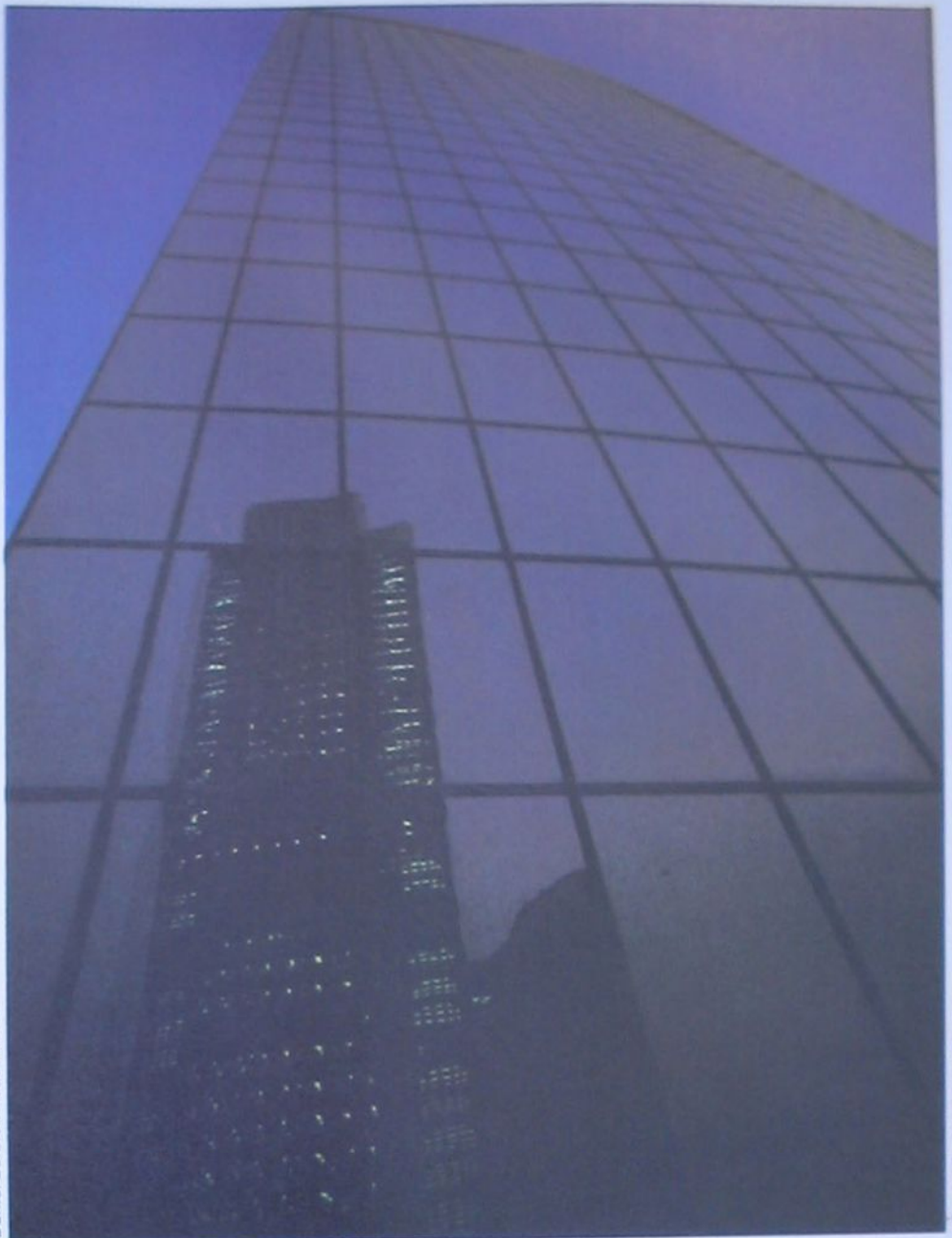
Daniel Barbier/Atlas Photos

Sculpture *A foreground object can often help to bring out the strengths of the main subject. Here the triangular shape of the modern sculpture, with its vivid colouring, heightens the surging energy of Paris's Tour Fiat in the background.*
Reflection *The strongly converging verticals of a shot straight up the side of a tower can be impressive—especially with a wide angle—but an extra detail, such as this reflection, may lift the shot out of the ordinary.*
Dallas *To photograph a building with an interesting shape, you should try to find a combination of viewpoint and lens which allows you to exclude any extraneous distractions, keeping the number of elements down to the absolute minimum. This lets the building speak for itself*

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Sylvain Grandadam/Explorer

resulting from shooting from a strange angle can often be the main point of the picture. It is not always necessary to hold the camera either vertically or horizontally. Holding the camera at an angle generally produces a rather weird and unnatural effect but this may be precisely what you need for some photos.

Strong diagonal lines or long curves sweeping from corner to corner give a dynamic effect and can look particularly effective when combined with tone or colour contrasts. Here wide angle lenses giving strange perspectives can be used, particularly from very close to the building, to give these strong lines. However, if you find that the wide angle makes precise framing difficult, switch back to the zoom.

If you look only at one building you may miss interesting contrasts and comparisons. Instead, try creating interesting angles between two or more adjoining buildings or shooting one smaller building against the stark backdrop of its larger neighbour.

As they have little colour of their own, modern buildings respond well to strongly coloured filtering. Try a violet or magenta filter to create a glamorous modernistic effect (but only on cloudy, overcast days). Blue filters give a cool, hard effect. And there is now a full range of graduated filters to make a bland sky more exciting and 'hold in' the composition. On bright sunny days, a polarizing filter may be found to give the best results, darkening the sky to a richer tone. Polarizing filters, however, also affect the reflections from windows and other reflecting surfaces such as perspex, so check the image in the viewfinder to ensure that the result you are getting is the one you want.

Reflections make bad enemies but

Dwarfed *Juxtaposing old and new architecture emphasizes the contrast between the styles of two eras*

Abstract *The patterns made by stark shapes, bright colours and patches of dense shadow typical of modern buildings can make effective abstracts*

good friends. If you fail to take them into account you may find that they are merely an annoying distraction. On the other hand, using them creatively can add impact to an otherwise boring shot. Look for interesting reflections in individual windows or, for a different perspective, move right back and use the building's entire expanse of glass. For example, try moving to another building, some distance away, and photographing an individual building or whole skyline at sunset or sunrise with the sun behind you. The glasswork will reflect the sun straight back at you, making the building stand out against a dark sky.

A similar and even more dramatic effect results when a building or buildings are caught by the sun breaking briefly through a brooding overcast sky. There is a large element of luck in such shots but you can increase your 'luck' by choosing your day carefully.

The lighting at the time you take your photograph will make a great difference to the final result so forward planning is essential for good results. If you want a detailed overall shot of either the whole of the building or a section, go at a time when the sky is fairly overcast, giving soft diffused lighting. Alternatively, abstract photographs, emphasizing the strong patterns and harsh lines of modern buildings, will probably have more impact if shot in a bright sun, when the contrast between bright highlight

Ian McKinnell

and dark shadow will tend to emphasize the pattern.

In addition the time of year needs to be carefully considered. Summer gives blue skies more reliably but on a crisp winter day the air can be cleaner, giving a clearer result with fewer low fluffy clouds. Winter will also have obvious effects on any foliage which appears in the picture. Some buildings will be partially obscured behind trees in the summer while autumn reveals clear lines and shapes. Other buildings, especially very recent ones, incorporate bushes,

Stuart Windsor
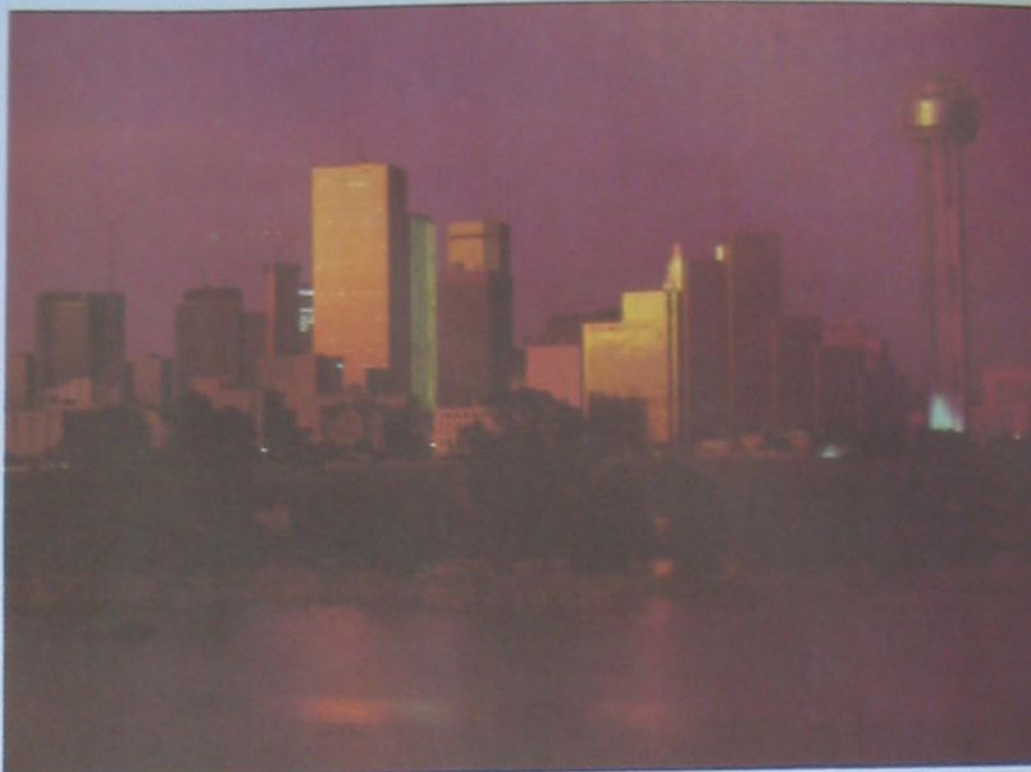
Dusk *Sunset makes the most of an impressive skyline as the skyscrapers, with their vast expanses of glass, stand out from their surroundings in rich, glowing colours*

The human element *However small in the frame, figures inevitably catch the eye, and provide a focus for shots of the slab sides of starkly designed modern buildings which may otherwise look rather dull*
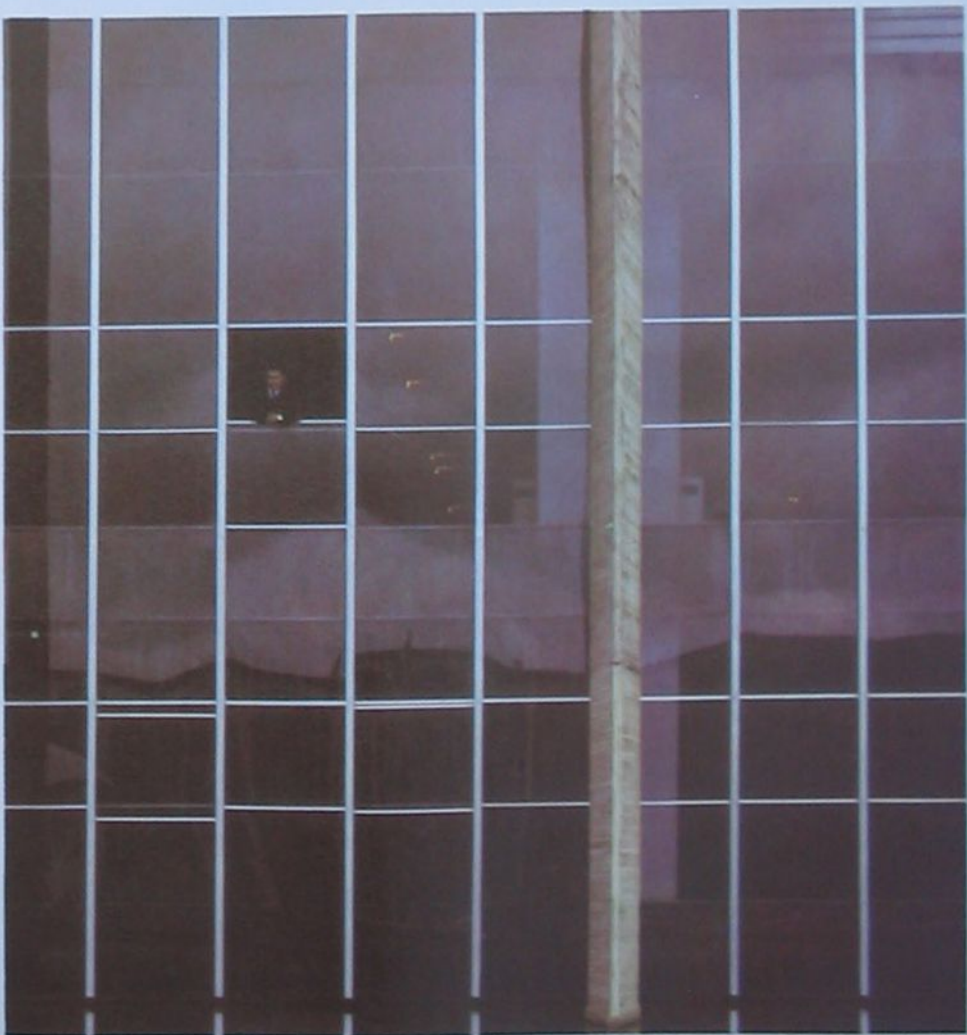
ivy or even small trees to deliberately soften the harsh uniformity of constant straight lines and these elements will appear at their best in spring or summer.

Your approach should always be 'sympathetic' to the building—you need not necessarily show it in a favourable light, but your treatment should be in keeping with its character. If the building scorns fussy detail and depends on strong, clean lines, for instance, then an equally bold, simple approach is probably most suitable. But ultimately, the choice is yours.

Robin Laurance

COLOUR ENLARGERS

For quality colour printing correct colour balance is essential, and the design of colour enlargers revolves around the filtration system, whether it is a simple colour drawer or a sophisticated mixing head

For colour printing, you do not necessarily need a special colour enlarger—an ordinary black and white enlarger can be converted for use for colour printing. But it must be fitted with a fully colour corrected lens to ensure good sharpness and freedom from colour fringes. And it must be possible to attach some kind of filter holder to the front of the lens to carry a set of gelatine tri-colour filters. You must be able to change these filters between exposures without the slightest movement of the enlarger.

Such a colour enlarger is something of a makeshift device and it confines the printer to the tricolour—or additive—method of exposing the colour paper. Although this method yields results as good as, or better than, those obtained by the subtractive method it is not quite as convenient to do and dodging is difficult (see page 590).

Subtractive printing

The simplest type of enlarger with which subtractive colour printing can be done merely has a filter drawer immediately above the condenser in which the necessary filter pack, made up from a set of yellow, magenta and cyan colour printing filters, can be placed. It is possible to use the subtractive method with an enlarger that has no filter drawer by using colour compensating filters instead of the less optically perfect CP filters, providing a suitable filter holder is fitted to the front of the enlarger lens. But there is a limit to the number of even the best filters that can be placed in an image forming light beam without loss of contrast and sharpness—about three.

Simple colour enlargers

Since colour printing became popular there have been a number of enlargers designed expressly with colour in mind. Some have developed an elegant

solution to the filter pack problem. Filters are brought into the light beam behind the negative by sliding them into place from a stack of mounted filters in a housing at the side of the lamphouse. In the case of the Paterson colour enlarger, say, five yellow, five magenta filters and three cyan filters are provided and there is also a colourless ultraviolet absorbing filter to complete the set. The filtration of variable filtration head enlargers is changed not by using a series of filters of different densities but by adjusting the amount by which single strong filters cut into the light beam. To ensure that the negative is illuminated evenly, the filtered beam is scrambled by multiple reflections in a mirror box.

With the aid of a colour

analyzer, even a simple colour enlarger can give good results consistently. Having set up a colour balance experimentally using a standard negative, filtration for subsequent negatives is fed in by altering the filter setting to give two null readings on a galvanometer.

The Kodak analyzer, for

Paterson Products Ltd.

Jon Bouchier

Drawers and heads
With the simplest colour enlarger, such as the Paterson (left), the filters are inserted manually into a colour drawer. With the more sophisticated colour head enlargers, the filtration is simply dialled in—often by remote control, as with the Philips (right)

Jon Bouchier

example, works on the basis of the integration of the whole negative and there is no way in which it can be used for spot measurements. Integration works well with average subjects but *colour failure* can arise with scenes containing a large area of single bright colour.

A close-up of a girl in a scarlet frock produces a print
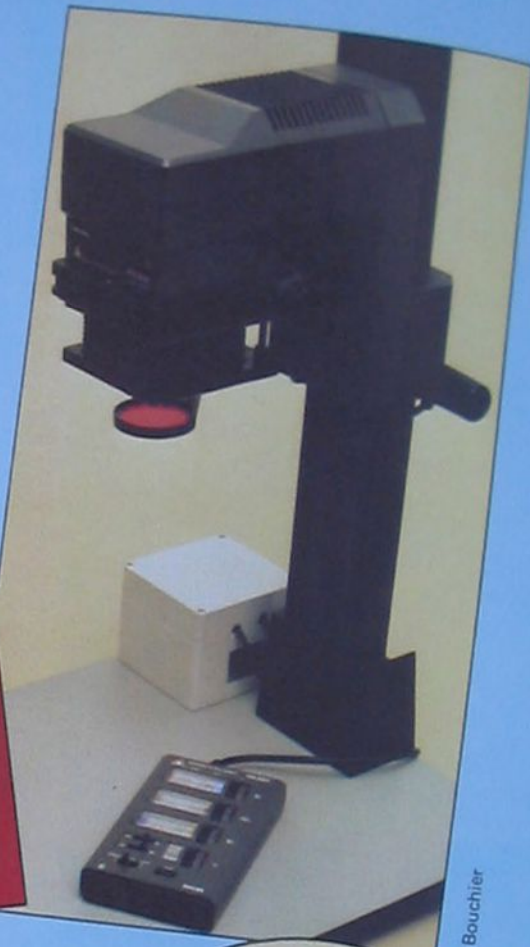
with a marked cyan cast when the filtration is estimated by an integrating system. The cast caused by colour failure is always complementary in hue to the main colour in the subject.

Colour mixing heads

Although simple enlargers of the Paterson type can give excellent results, there is no doubt that manually changing the filtration for every negative can be very tedious and time-consuming. Most modern colour enlargers, therefore, have a colour mixing head which includes all the necessary filters and allows filtration to be simply dialled in.

Most colour head enlargers have just a single light source, and the filters—for yellow, magenta and cyan—are simply moved into the light path between the light source and the condenser. The light source is usually a tungsten halogen lamp which gives good colour and light intensity right to the end of the life of the bulb.

Rather than the basic gelatine or acetate 'absorbing' filters used on simple colour enlargers, most colour heads use *dichroic interference* filters because of their durability and freedom from fading. Dichroic interference filters consist of a thin glass support carrying vacuum evaporated layers—16 to 25 in number. These transmit a selected spectral range and reflect rather than absorb the rest. So they do not get hot like conventional filters that work by absorption.

Every manufacturer has his own series of filter values. Durst for example number their control knobs from 0 to 100 but the numbers are arbitrary and are not the same as the numbers of Kodak CP filters which are based on the density in the region of maximum absorption. For instance, a Kodak CP30Y filter has a density of 0.30 to blue light. The Agfa-Gevaert colour printing foils have yet another numbering system and 100 on the Durst scale is equal to 200 on the Agfa-Gevaert, and the numbers of the latter are not related to their density.

Instead of a single light source, some colour heads use three separate, independently adjusted light sources, each with its own dichroic filter—one red, one green, one blue. The colour balance is made by adjusting the relative brightness of the three lamps—the overall brightness is maintained electronically, so you do not have to make any exposure compensation.

Diffusers and condensers

Colour mixing heads usually provide diffuse illumination because of the need to scramble the light after it has been filtered. When a colour mixing head is used to replace the normal condenser system of a multipurpose enlarger the latter is removed. A colour enlarger with a non-interchangeable colour mixing head can be used for monochrome enlarging and the diffuse illumination system helps to subdue superficial defects such as scratches on negatives. It gives lower monochrome print contrast than a condenser enlarger because of the absence of the Callier effect (see page 2185). There is little difference between condenser and diffuse illumination with colour negatives as their images are of dyes which do not scatter light very much.

On-easel analyzing

An on-easel colour analyser complements an enlarger with a colour mixing head although it is by no means essential. The enlarger can be used in exactly the same way as a less sophisticated one with a filter drawer except that there is no fidling with filter foils in near darkness. An on easel analyser may be used for either integrating or spot negative evaluation, but the latter demands a suitable reference area in the negatives such as the image of a grey card.

When using a colour mixing head with an analyser, problems can arise with colour balance when high filter values are involved. The spectral density curves of the filters may not match the dye density curves of the negatives and the spectral sensitivities of the printing paper. If this problem arises, it may be advisable to insert some appropriate colour printing filters in the enlarger to reduce the amount of dichroic filtration that would otherwise be needed.

Colour mixing head

filtration control dials

mixing box

Durst M605 Color

negative carrier

mask controls

dichroic filters

tungsten halogen lamp

head height adjuster

As in most modern colour heads, the filters in this Durst enlarger are dichroic and absorption depends on the angle at which they cut into the light path
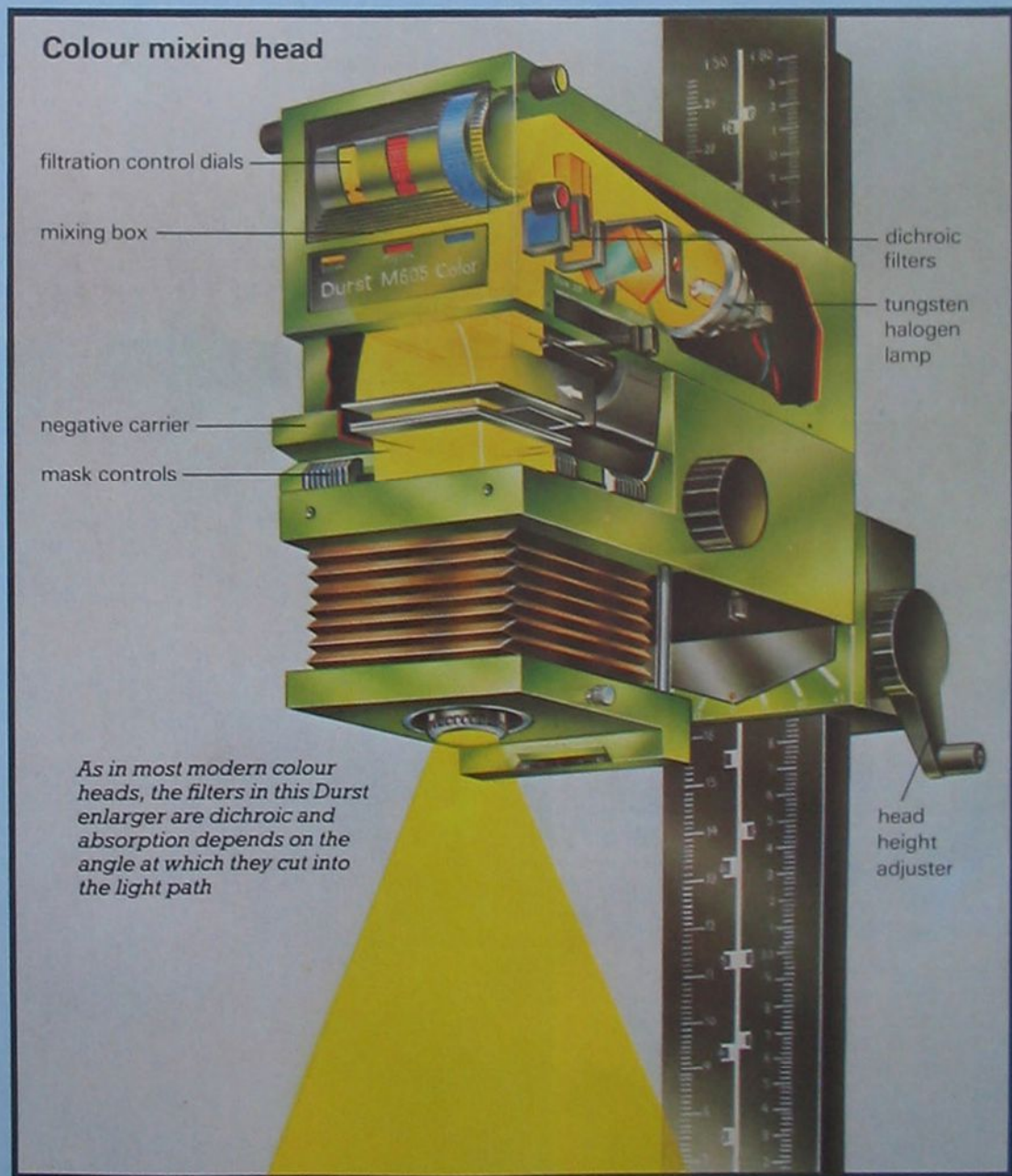
CAMERAS AT RISK

Most high quality cameras are delicate and easily damaged—even a day on the beach can wreak havoc. So if you want to shoot in hazardous conditions, what equipment should you use?

Dave King

Most people treasure their camera and would not dream of subjecting it to any form of rough use. But from time to time a camera may be required to either go with the photographer into a dangerous place, or even go where the photographer does not dare.

The likely hazards to a camera can take many forms. One that is encountered commonly is rain or sea spray, but flying grit, mud, or perhaps even stones are typical problems at car and motorcycle races. Such hazards are usually expected, as is the risk of knocking or dropping the camera if you attach it to a kite or model aeroplane for aerial photography. The risk of assault is particularly important in reportage work, when someone may set upon you and try to smash your camera. In fact, the possibilities are numerous—they include explosions, fires and theft. These risks can be minimized if you use the proper equipment and take proper precautions while using them.

Choosing the equipment

One way to avoid damage to equipment is not to use it. Instead, use cheap, expendable equipment. The cheapest—they can even be free—are old box cameras, 126 cameras or even 110s. The results may not be grand, and the range of conditions in which you can use them may be limited, but it is often possible to acquire a stock of such cameras at no cost, simply by asking friends and acquaintances.

For greater versatility, you can get worthwhile cameras for less than the price of a roll of process-paid colour film, if you know where to look. There are many excellent non-reflex cameras from the 1950s and 1960s, with high quality (but scale-focusing) lenses of reasonable speed, say f/2.8 or f/3.5, and shutters with a good range of speeds.

If you want a camera that is yet more versatile, you can buy an unfashionable secondhand SLR. Used Exas and Prakticas are cheap and give you access to a huge range of lenses; you should be able to buy a couple of bodies and three or four lenses for the price of a modest new SLR. Alternatively, you can buy a camera with a more unusual lens mount, but with a wider specification. Mirandas, for example, are often absurdly cheap, and minor faults, such as faulty self-timers, can be used to help get the price reduced.

Cameras made in Russia can be bought new as cheaply as many other secondhand SLRs, and can give excellent results considering their low price. The Kiev, which is a copy of the Contax, has Leica-type interchangeable lenses and is cheap and quiet. But the

Waterproofing *Guard against water or spray with a waterproofed camera or a camera and housing. Minolta's Weathermatic (left) and the Ricoh A2 with housing (below) are robust, but, for rough work, cheap old cameras are better (right)*

climbing equipment by Pindisports

Dave King/climbing equipment by Pindisports
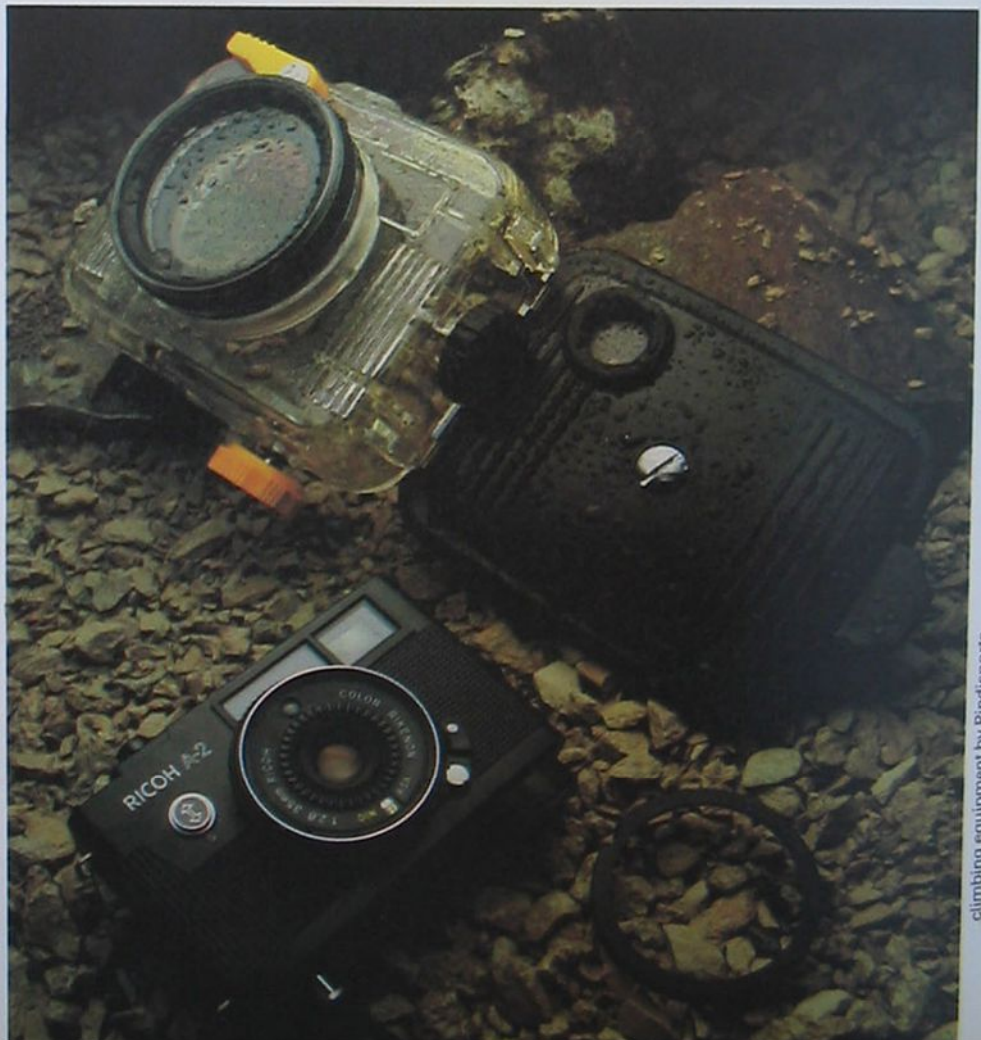
New but cheap *cameras, particularly those made in the USSR, are ideal substitutes for more expensive models*
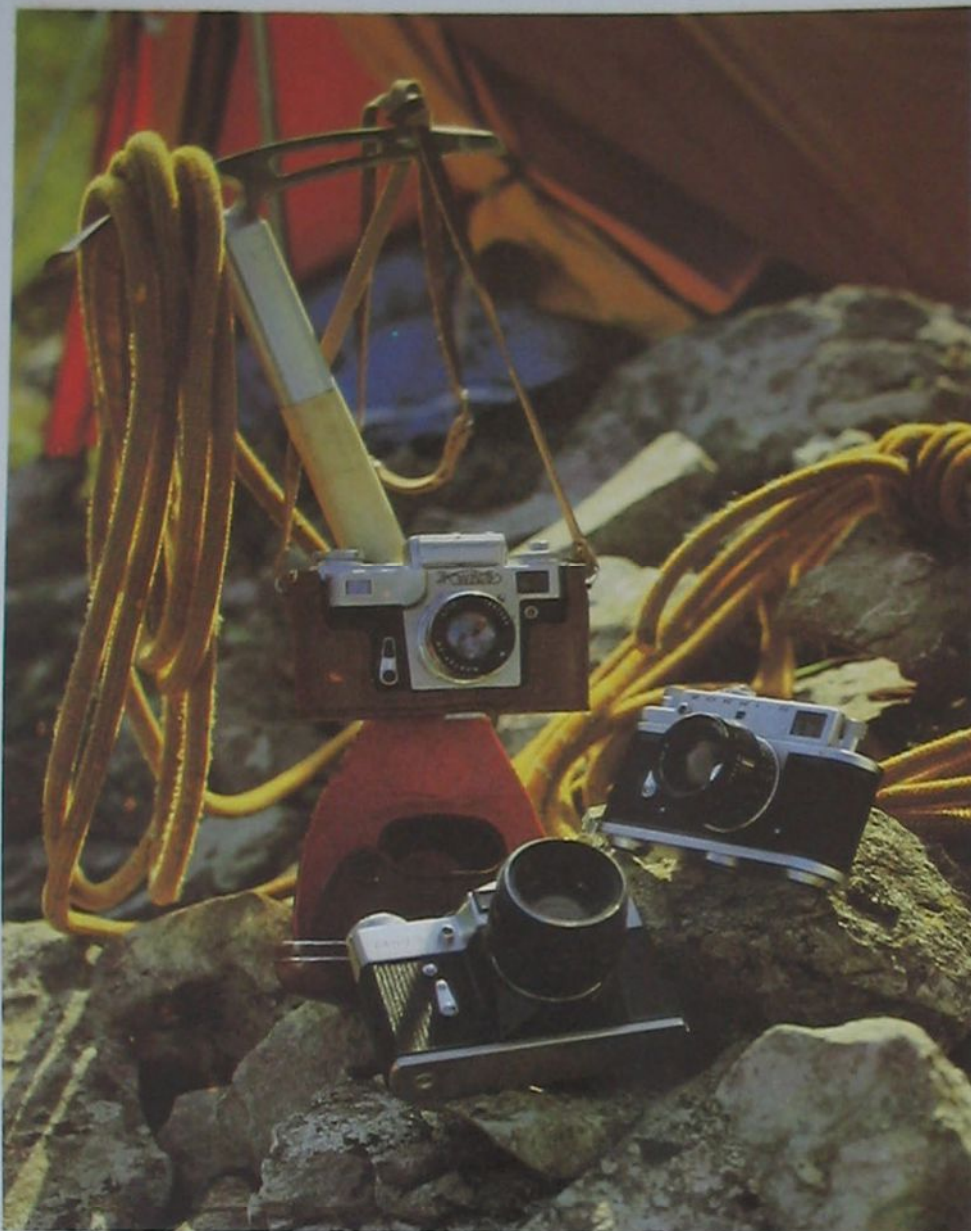
most famous Russian camera is the Zenith, also available under other names, such as Cambron in the USA.

The Zenith has its limitations, though none of them are serious. It has a limited range of shutter speeds—none faster than 1/500, none slower than 1/30, except for B. It is heavy, and takes obsolescent M42 screw thread lenses. Its tripod bush is annoyingly located to one side, rather than being central on the baseplate. This means that people tend to overtighten tripod screws, to hold the camera firmly when taking vertical shots, and this can damage the far end of the tripod bush. This, in turn, can prevent the shutter from operating properly.

Zeniths do tend to suffer from shutter defects, but apart from that they are rugged and very cheap. Their lens, while not good, is perfectly adequate for most purposes. Anyone who may have to use a camera under unfavourable conditions, yet requires SLR versatility, could consider a Zenith.

At similar cost, you should be able to find good twin-lens reflexes. These will give you the quality advantage of the larger format, and are virtually indestructible—old Yashicamats, Microcords and other Rollei copies seem to go on working forever. Rollfilm folding cameras are not such a good choice, because they are mechanically weaker.

For the utmost in versatility, you can buy a high-quality camera. Old Nikon Fs, for example, are about the same price as a modest, new SLR, but their strength is legendary. Rolleiflexes are another good choice.

Also worth considering is the little Robot (see page 1746). With its stainless-steel body and built-in spring-driven 'motor drive', it is ideal for relatively low-cost remote operation. Its strength is tank-like, and although alternative lenses are hard to find, it is easy to make an adapter for the simple screw mount. Its drawbacks (which account for its low secondhand price) are its relatively limited specification, its 24 × 24 mm picture format, and the need to use film cassettes that are unique to the Robot.

If you intend to photograph extensively in difficult conditions, it may be worth buying a purpose-built camera. Usually these are of limited specification but they are built to withstand the most appalling conditions. In any event, simplicity is always the best policy when choosing equipment for specialized use. Mechanisms that are not incorporated cannot go wrong, so always use the simplest camera compatible with doing the job. Beware of electronics, especially if you work in rain or sea spray.

The best known, and probably the best, special-purpose camera is the Nikonos. This is not only waterproof down to about 50 m deep, it is also mechanically extremely strong. A scale-focusing 35 mm *f*/2.5 lens is not particularly extraordinary (there are others for underwater use); much more impressive is the fact that you can hose the camera down after a hard day's work.

Fujica's HD (Heavy Duty) cameras are not as rugged as the Nikonos but they are much cheaper. They can survive the occasional dousing, but are not designed for underwater use. The Minolta 110 amphibious camera is cheap, strong and simple, but it is essentially a box camera with the limiting 110 format.

There are only two accessories that really concern the hazardous-use photographer: the meter and the flash. The cheapest secondhand Weston meter you can find is the best choice. Use it inside a tough, clear plastic bag in rain or spray, allowing maybe ⅓ stop to account for the bag. For flash, use either a cheap electronic unit inside a plastic bag or a bulb flash. These are powerful, reliable and inexpensive secondhand.

Custom-built cameras

Some of the most extreme conditions are encountered by industrial photographers. But a camera protected for one particular type of hazard will, most likely, be unsuitable for use in other types of hazard. For this reason, camera housings are made to order; ready-made housings are usually available only for underwater use.

A camera that is well protected against blasts, for example, might be so bulky as to be unsuitable for photographing the interior of an oil or gas well—often necessary during exploration. In a pressurized well, a main consideration is the risk of starting an explosion. And the camera must be kept small and simple to minimize costs. So instead of an elaborate arrangement of controls, operated through multicore cables, a self-contained camera and housing are used, operated automatically by battery powered timers.

In the darkness of an underground well, the image path must be kept separate from the illumination path, and this adds to the complexity of the housing. Nevertheless, the design remains fairly conventional, using the usual industrial 'O' ring rubber seals, for example, to make the housing gas tight.

CITY
close-ups

John Heseltine
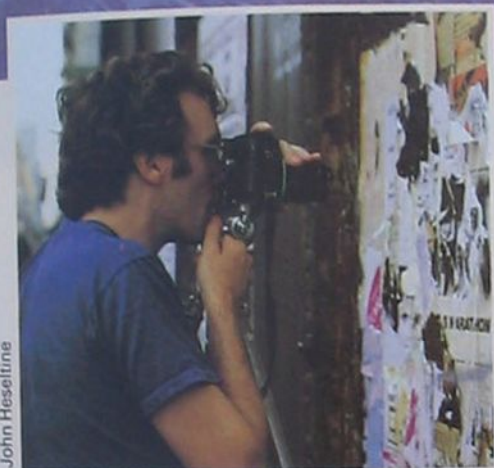
Close-up photography is often associated with natural history but New York photographer, Alan Porter shows that there is just as much scope for closing in on urban subjects

Almost every time you walk along a city street you pass small details which could make fascinating photographs when isolated with a macro lens. For this assignment we wanted to demonstrate the creative potential that can be exploited once you have trained your eye to look at your surroundings in miniature rather than always trying to deal with wider, overall views.

In order to provide a graphic illustration of this point, we asked New York photographer Alan Porter to take some close-up shots while walking

Wet leaf *A shower of rain looked like ruining a day's photography but turned this oily mess into a glistening study for Alan's 55 mm Micro Nikkor lens. The tripod's lateral arm made it easier to point the camera straight down towards the ground.* **Faded colour** *Even faded paintwork and corrosion can make beautiful pictures in close-up—this is a panel on an old garbage truck that caught Alan's eye*

Alan Porter
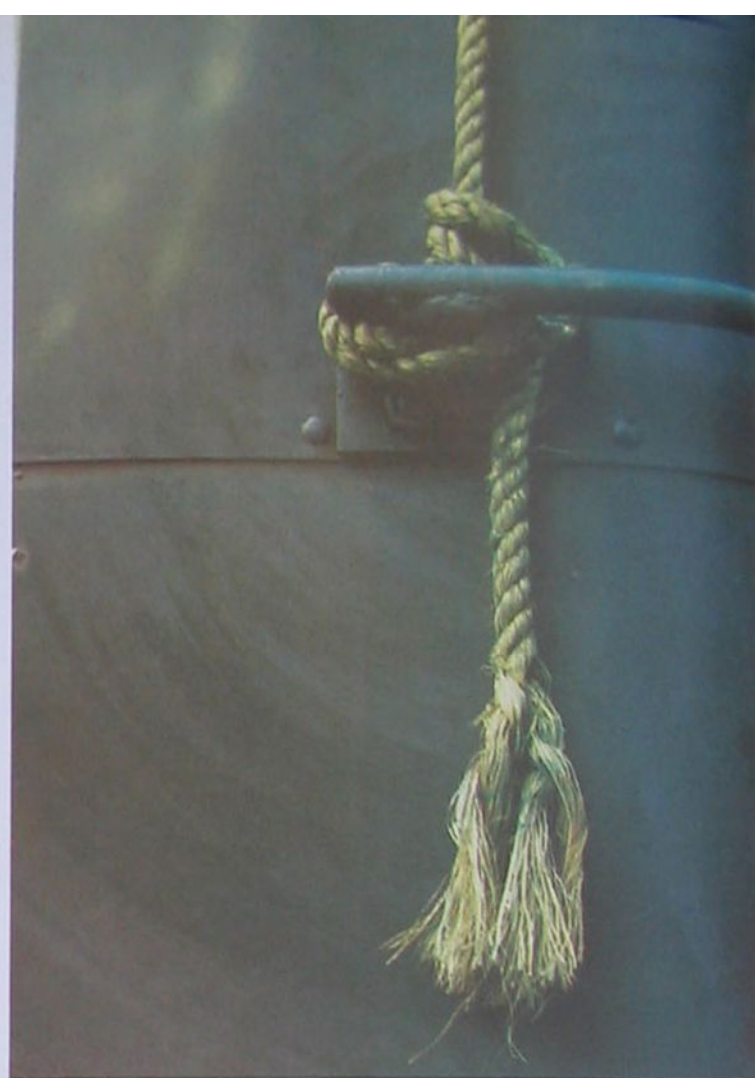
Shop window *A close look at this shop window revealed a strong contrast between the bold neon sign and the faded magazine cover looming out of the background. The graphic effect was achieved by very careful framing.* **Rope** *A rich contrast in colour and texture at the rear of another truck provided Alan with striking abstract.* **Brick wall** *The colours and shapes made a strong composition when isolated by the close-focusing lens*

around his Manhattan neighbourhood. Even though his professional work is mainly connected with studio still life shots, Alan also has a keen interest in making detailed studies of his everyday surroundings using just a 55 mm macro lens on his Nikon F3.

Peeling paintwork, rusted metal and crumbling maisonry are the types of subjects which Alan often chooses to photograph, concentrating on textures, shapes and subtle contrasts in colour. He is quite prepared to manipulate and arrange these subjects as he would in the studio in order to make a better photograph. He explained, 'Whatever you can do to make a beautiful and striking picture is fair enough. Some people feel that moving things around to suit the composition destroys the purity of the subject. But I feel that it is more difficult and more of a challenge to arrange things effectively than to just photograph them as they are. Both approaches are fair.'

This manipulation usually involves looking for good subjects and backgrounds, and then combining them—unless, of course, Alan notices something that is fine just the way it is. Walking

Alan Porter

Razor blade *The side of a huge old dictionary proved an ideal background for a shot of a razor blade that Alan found.*
Encircled rust *The concentric rings and pitted metal show how even the least obvious subject catches the eye when studied in close detail*

along looking for material for this assignment, for instance, he found a rusty old razor blade and was immediately struck by its colour and texture. 'At the time, I had a leaf with me and I was looking for a suitable background. Then I stumbled across this old dictionary that someone had discarded, and tried to photograph the leaf lying on the book. Then I realised that the razor blade would work well lying across the side of the book. People give me funny looks when they see me with my camera and tripod set up on the edge of the sidewalk, but you get used to it after a while. Once they find out that you are not working for the city or the government, they become less suspicious!'

In order to make the most of the textures and colour which feature in these subjects, Alan opted for Kodachrome 64 transparency film. Working at such close range meant using small apertures—usually f/11 or f/16—to ensure that everything was kept in focus. In order to steady the camera he also used a Gitzo tripod fitted with a lateral arm which he finds invaluable for close-up work—the lateral arm allows him to shoot down from just the right viewpoint.
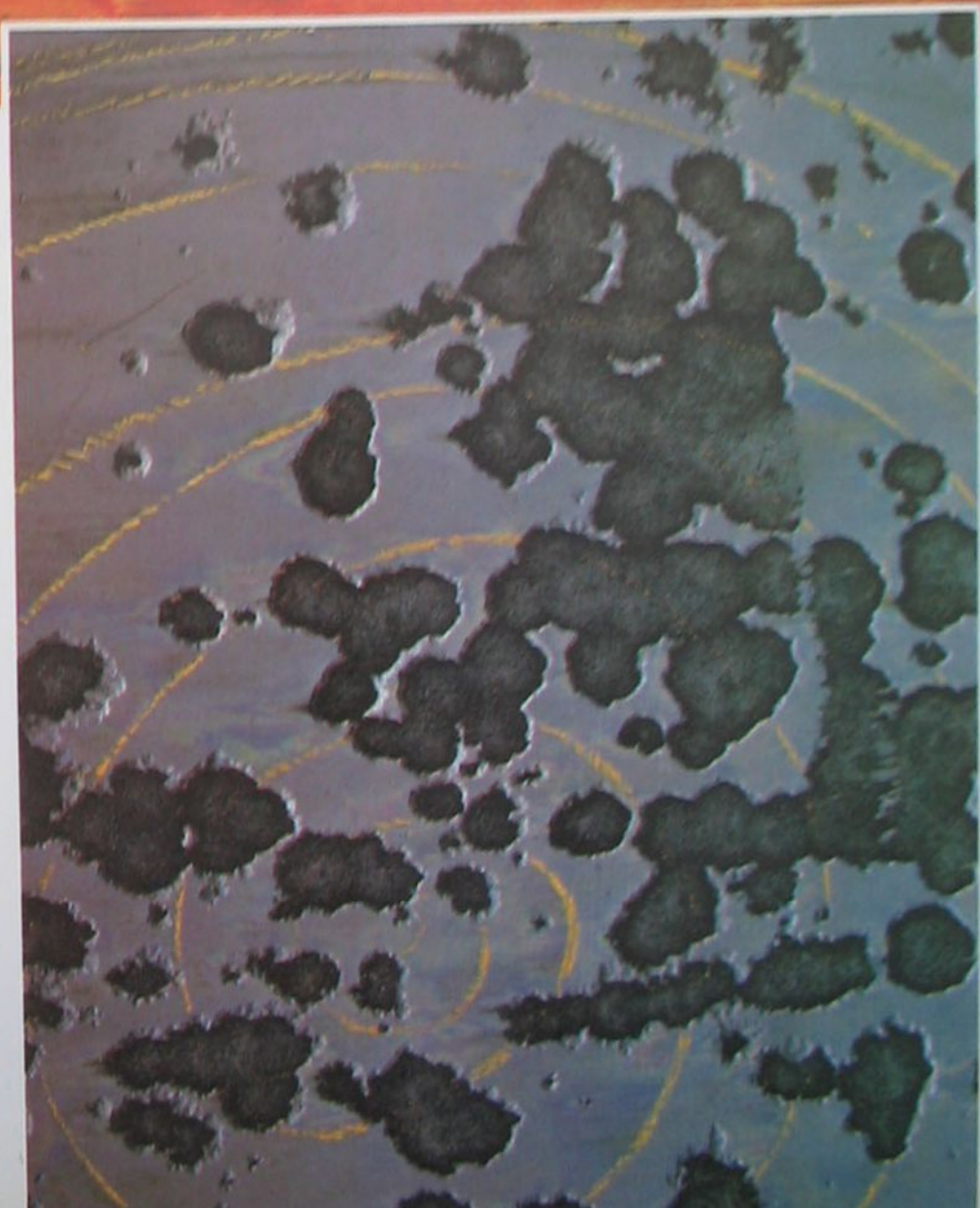
DAVID BAILEY

Since his meteoric rise to success in the 1960s, the British photographer David Bailey has established himself as one of the world's most creative and original photographers

When David Bailey first made his name as a photographer in the 1960s he was known not only for the freshness and originality of his fashion photography but also for the direct style of his portraits. An extrovert personality who enjoys being in the public eye, Bailey managed to combine his talent for publicity with a very real talent for photography with the result that he is one of the few photographers who really is world-famous.

Even after 26 years of photography, Bailey is still passionate about taking photographs. 'It's what I like doing. I like it for the same reason that people like painting or growing orchids. It's something you can't help. You've got to do something for 60 odd years, so you might as well stick to the things you do best. I used to play the trumpet. I rejected that because I decided I was tone deaf. But I still paint occasionally and sometimes write—though not seriously. I do a bit of movie stuff as well. Anything to do with the visual really.'

Nowadays, Bailey does very little of

The photographer *in a reflective mood, as portrayed by his assistant, John Swannell*

John Swannell
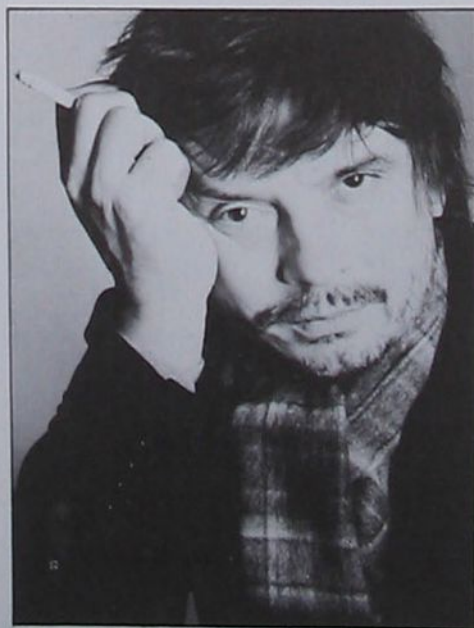
the fashion photography through which he became famous, although he still continues to take a lot of portraits and pictures of one of his favourite subjects —women. Indeed, he now photographs practically every subject imaginable— with the possible exception of still life. And although his major source of income is advertising, as a stills photographer and the director of television commercials, his career has branched out in several different directions.

Since 1968 he has directed and produced a number of television documentaries and he was instrumental in setting up the magazine *Ritz*.

Bailey attributes his success not only to his love of photography but also to a worldwide approach to photography which he feels is essential. 'If you want to be successful in what you do, you have to be international. That's the trouble with most of the English photographers. Nobody knows them outside London. The only working commercial photographers they know about outside of England are Norman Parkinson and Tony

David Bailey

At the dock *Shot in Haiti for Italian Vogue showing Bailey's mastery of composition and design*

Sardinia, 1982 *This enigmatic picture is characteristic of the kind of photograph that Bailey enjoys taking in his spare time. He is planning a book of such images*

The Kodak girl, Goa, 1970 *Another of Bailey's projects is photographing this cardboard cut-out wherever he comes across it throughout the world*

Snowdon. You have to keep working for clients all over the world.' Bailey certainly tends to follow his own advice. A recent trip involved him making six commercials for a German client. His intinerary took him from Munich to Hong Kong to Rio to New York and in between these he fitted in another commercial in Milan.

Working in Italy is something he particularly enjoys. 'Mind you, everything takes you a day longer there. They're pretty laid back. It's always *"domani"*.

But you can bend the rules there a lot more than you can in England where art directors usually come to you with a layout which you have to stick to. In Italy they are more likely to say, "Oh, if you think it looks better the other way, do it the other way."

'Half the time you won't even have a layout. They've got the attitude that if they're employing you, it's up to you how you approach the job. The Japanese are similar. If you work with them you can't ask their opinion—they would think you were mad. Once they've asked you to do the job, they don't want to interfere. They're paying you to do it. In America and England, it's more a team thing.'

Nevertheless, Bailey also enjoys working with a team. It is one of the reasons he enjoys so much of his commercial work. 'There are not many good art directors or good copywriters around. But I tend to work with the best. I work a lot with Collett Dickenson Pearce, for example, who are probably one of the best agencies.'

Bailey started taking photographs as a small boy, but went professional after completing his National Service with the Royal Air Force, when he became an assistant to the fashion photographer John French. Just under a year later in 1959 he began contributing to British *Vogue* and he has worked for them ever since. Although nowadays his work for them is almost exclusively portraiture, he was under contract to them for several years to photograph fashion.

2547
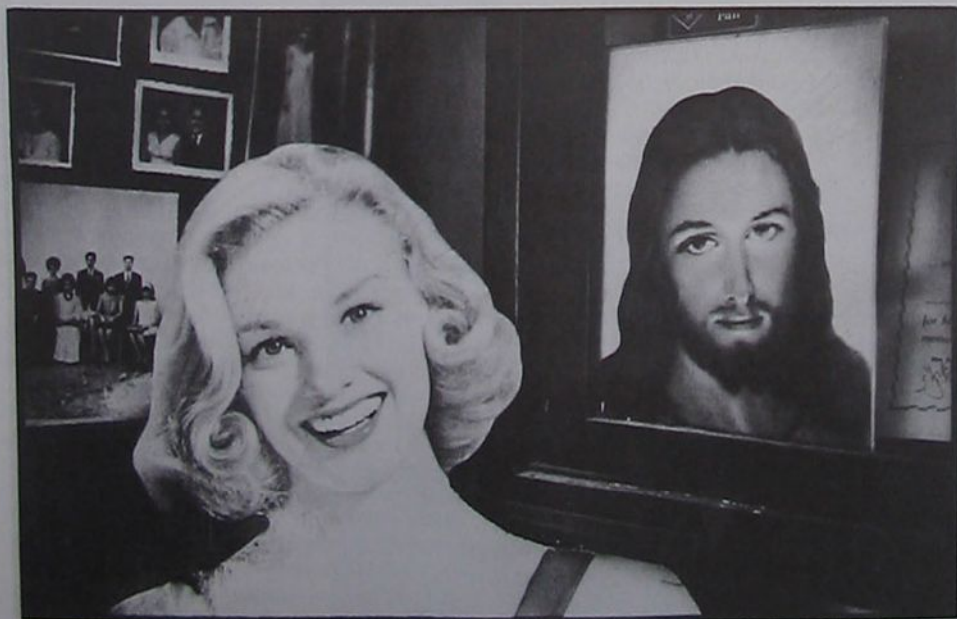
In those early days Bailey's strongest photographic influences were the American photographers Richard Avedon and Irving Penn who brought a new direct look to fashion photography. 'I think that one of the greatest fashion photographers of all is Richard Avedon. He has this kind of *nouveau riche* New York magic. I mean he turns fashion photographs into magic—bad, vulgar New York taste. That's wonderful.'

But Bailey himself is also an innovator and it was his ability to ignore the rigid rules that had previously governed fashion photography and introduce a more natural look that made him so successful. 'Fashion's such a peculiar thing. Not many people understand fashion photography. It's something that you can't explain, most people just take pictures of girls in a situation. They don't understand about the woman. The girl has to look good. And if she doesn't look good, it's all a nonsense. Also you have to show the clothes. If you don't do that you're cheating. Fashion photography is about selling clothes—about moving

dresses off the rack. People won't come back and use you again if you don't show the frocks.'

A large part of Bailey's success as a fashion photographer has undoubtedly been in his choice of models such as Jean Shrimpton and Penelope Tree in the early days and, more recently, models like Jerry Hall and his wife, Marie Helvin.

'I like working with my friends. I don't really like working with girls I don't know. I hate that dolly model nonsense. I've always photographed models like personalities. That's why they become well known. And I know how they react and what clothes they'd like, the way they like their make-up, how they smile, which side of the face is best . . .

'Not that that's what I've been doing recently. Lately, its been much more about the photograph. I've been using the girl almost as a still life. They're like pictures by the French photographer, Atget, with a girl in them. You see, there are so many wonderful buildings and gardens, especially in Italy. I just love photographing them and, as an excuse, I

put the girl in at the last minute. I'm changing that attitude a bit because I've got that idea off my chest now.'

Over the years Bailey became as well known for his portraits as for his fashion photographs. He enjoys portraiture quite simply because he likes people. 'I'm interested in how people change and what we've done with civilization. I don't mind whether it's good or bad—that's for other people to decide. A beautiful rock in Scotland is going to be there in 500 years time unless we blow the whole thing to bits and then it won't matter anyway. But people change all the time and I quite like recording that change.

'For me, half the enjoyment of looking at portrait paintings is looking at the way people dressed in the past and the way they looked in a particular period. A picture becomes a historical document, whereas a landscape is pretty much the same—it's not going to change. I like recording the dress of civilization and showing people wearing particular clothes at a particular time in history. Not the fashions, you understand—the social

2548

Veiled lady The model, Marie Helvin, is also Bailey's wife and one of his favourite subjects. Here she was photographed on assignment for Yves St Laurent

Wallpapered One of the curious set of images showing 'ways of wrapping women' that Bailey is collecting together for publication

High-heeled sandal The eroticism of this image lies entirely in the idea behind the photograph and the suggestiveness of the pose. It was one of many celebratory pictures of his wife in Bailey's book 'Trouble and Strife' (Cockney rhyming slang for 'wife')

John Lennon and Yoko Ono *This portrait of a famous couple shows Bailey's ability to create very strong images with the simplest props. Shot on 10 × 8*

implications of it all. I can only add one thing to it. I'm a particular person at that time, recording that look.'

This sense of being 'a particular person' recording what he sees is very important to Bailey. He feels that good portrait photographers should have a definite point of view. 'Any good portrait photographer tends to make people look a particular way. If a photograph is by Karsh or Avedon, you can tell straight away. People criticize them for that, but in a way that's their strength. Otherwise it would just be a styleless portrait. You do need a point of view in photography.

In spite of this feeling, Bailey is quick to point out that this point of view should not be contrived. 'There's been a lot of nonsense talked about whether something is meaningful, or whether you've captured your sitter's soul. Who wants their soul anyway? I just want an image.'

As a photographer who really enjoys taking pictures, Bailey always carries a camera with him. He ends up taking a 'couple of thousand' pictures a year and about half of these are just for himself. He reckons that if he's lucky, he gets about six good shots in a year and he usually knows when he has taken one. 'You just know everything's right. The light's right, the situation's right and the picture's right.'

A recent trip to Sardinia to do a Cinzano advertisement produced one such image. 'I thought as soon as I'd done with Cinzano I'd go back to this working class holiday resort I'd seen and do some pictures. It looked like it was a fertile place for images, without being too obvious.' The shot was a deceptively simple picture of a woman's bathing suit hanging in front of a house. He enjoys taking shots that show this kind of personal detail and he is thinking of collecting a few such images into a book.

Bailey is a master of photographic technique and loves to experiment with equipment. He estimates that he owns 'maybe a hundred' cameras and probably uses all of them 'on and off'. As he says, 'They're not collector's items; they're all functional. Their formats range from half frame to 10 × 8. It is boring to say this, but cameras are just like cars. If you're going across the desert, you'd be stupid to go in a Ferrari. You'd take a Land Rover. The same with cameras. If you're going to go up the side of a mountain, you'd take a 35 mm. You're not going to cart a 10 × 8 up there. The camera fits the job. The job dictates the camera.'

When travelling, he takes Olympus cameras with him 'because they're small.' He has several OM2s and the complete range of lenses. 'But basically I only need three lenses. I use the 24 mm, 35 mm and 80 mm most. I could probably manage with those three. With my Leicas, I use the 28 mm, 35 mm and 90 mm.' He also uses the 5 × 4 format quite a lot at present and for this he is using a Linhof.

Although much of his photography is taken on location, Bailey also has a small studio in his house near London's Regents Park. Here he takes some of his portraits, but for other studio work he prefers to hire studios wherever he happens to be working.

An ardent fan of black and white photography, Bailey prefers it because of the control he has over it. He feels that colour is so much in other people's hands. 'There's some man in a white coat at Fuji or Kodak, who decides what colour red is. And, in a way, they decide on the colours more than you do. Also one lab makes your film yellow, another lab makes it green. But I'm going to muck about with colours soon. I want to do a book of shop windows in colour.'

Mick Jagger *Taken on Primrose Hill as dusk was falling. Bailey used electronic flash to fill in the detail, and shot from a low angle*

Jack Nicholson *A personal portrait of an old friend taken in the studio on 5 × 4. Bailey enjoys taking portraits and has gained much of his fame through them*

Joseph Losey *Double exposure has been used to great effect in this portrait of the British film director. Taken for British 'Vogue' in the late 1960s*
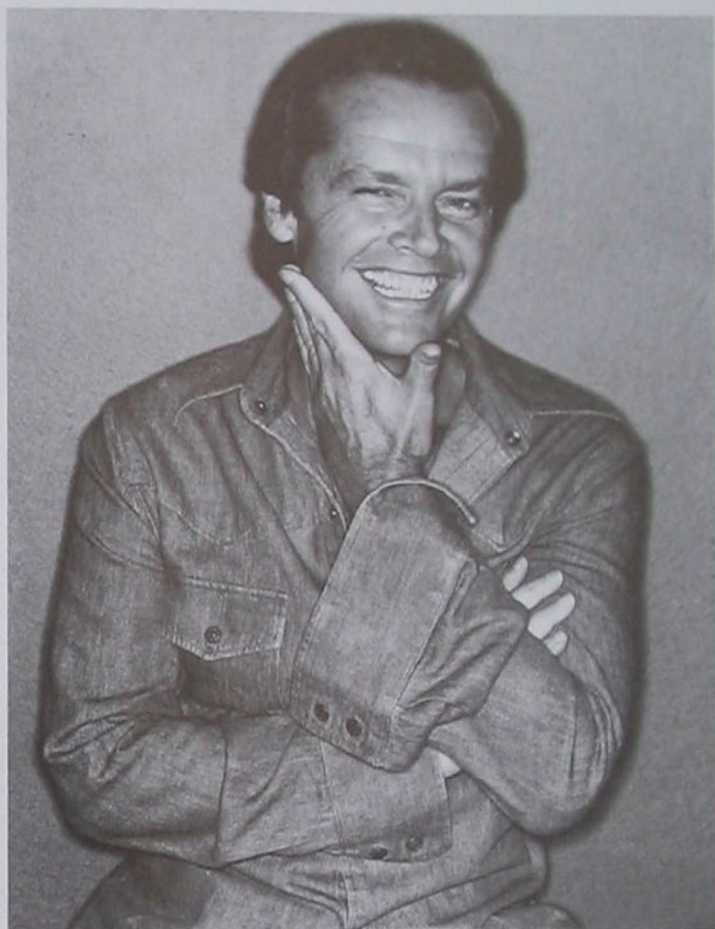
all photographs by David Bailey

calculated to appeal to the female market. He is aware that it may incur the displeasure of the women's movement but professes not to care about the public reaction to the book.

'I can't be responsible to them. As a friend of mine said to me, "I'd like everyone to like me and I'd like everyone to like what I do. But the world isn't a perfect place and things are not like that". I'm afraid that's what it's like with my nudes. That's the way I see things and that's the way I'm going to do them. It's nothing against women because nobody loves women more than I do. I mean if I was homosexual, they'd be wrapped up men, so it's not that.'

Another of Bailey's more recent books *NW1* is a complete contrast. It is a series of pictures of the architectural features of the area he has lived in for many years. Most of the pictures were taken on Sunday mornings 'when there aren't any people around.' It was a labour of love and Bailey does not expect it to be a commercial success. Its print run of 3,000 is much less than the more commercial *Trouble and Strife* which went to 40,000.

David Bailey has come a long way from the young *enfant terrible* who with Terence Donovan and Duffy made such an impact on the world of fashion photography in the early 1960s. But the intervening years of fame and fortune have not worn away the essential ingredients that brought him that fame in the first place—a continuing enthusiasm for photography and a constant stream of new ideas.

Bailey does all the printing for his exhibitions and books, using Ilford Galerie and Agfa Record Rapid paper. But he uses an outside printer for his press work or when he doesn't have the time to print himself.

He uses a wide variety of film, although for most of his commercial assignments he will take mainly Ektachrome 64, with a back-up of some Ektachrome 200. For his black and white photography he used Ilford Pan F. 'But I wouldn't make rules about it. I use everything. I use FP4 a lot too, especially for my 5 × 4 work.'

Like most photographers, Bailey enjoys seeing his work reproduced in books and he has published a lot of them. They range from *Goodbye Baby and Amen,* his book documenting the famous faces of the 'Swinging Sixties' to a recent book of semi-erotic photographs, *Trouble and Strife* (Cockney slang for 'wife'), featuring his wife, Marie Helvin.

A more recent project is a book of nudes which is a photographic exploration of 'ways of wrapping women'. It was inspired by a Japanese book on wrapping objects, and is hardly

FLASH by night

Using flash outdoors is very different from using it inside, and exposure can be quite tricky. Fortunately there are some simple techniques to help you solve these problems

Vautier/de Nanxe

Carnival flash *Here the background, hats and bright clothes have helped to outline the subjects*
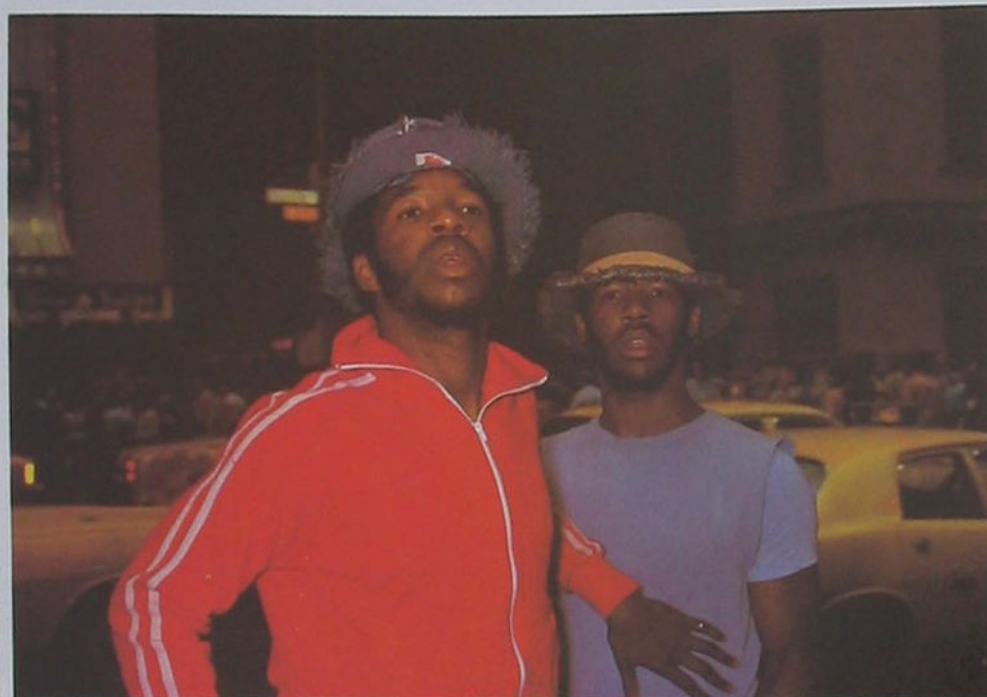
Now that flash has become accepted as a tool to give better lighting under many daylight conditions it is easy to forget the more basic use of flash: to take pictures in the dark. And even those who have mastered the technique of using flash indoors and fill-in have trouble taking pictures outdoors at night.

The main problem with using flash outdoors at night is that the resulting pictures never look quite like what you saw through the viewfinder. This is because the quality of flash lighting is quite different from what you normally see. Night scenes are often illuminated by a number of weak light sources: streetlamps, light from doorways or windows or car headlamps. Once your eyes have become accustomed to the dark you can see these. But the light from a flash is much brighter and, usually, harsher. Your camera sees only that and not the weaker available light.

Direct flash
The available light that you can see gives toplighting, sidelighting and back-

lighting, but the flash on your camera only gives frontlighting. This is the sort of lighting you get when your car headlights pick up a figure in the dark. It shows up colours, patterns or writing very clearly—so it is good for photographing flat, non-glossy objects. But it is bad at revealing overall shape, form and texture, unless the subject is flat, shiny and at right angles to you.

Using frontlighting alone it is easy to lose the edges of subjects. People with dark hair, dark skin or dark clothes may merge into the surrounding darkness. These problems arise both outdoors and in very large interiors with low ambient lighting.

The simplest way to overcome this is to put your subject against a nearby light background, so that any dark areas are outlined against a paler area rather than blackness. If you are out in a field even a bush or hedge will do, as long as your

subject is fairly close to it. If there are no hedges about, try getting up high above your subject so that the field itself provides a backgound. One drawback with this approach is the characteristic hard shadows on the ground that flash often produces. Alternatively, make sure that your subject has white or pale-coloured extremities—a white hat and gloves, for example, would prevent a person's features from merging into the darkness.

Even an automatic flash, which normally adjusts the flash output to give the correct exposure, can often give poor results. One common failing is to forget that every auto flash has a maximum working distance, which is easily exceeded out of doors. But even within its working limits, the auto sensor can still give the wrong results. For example, if the sensor reads only a person wearing light coloured clothes, the result may be underexposure. But if the sensor's angle of acceptance includes an area of dark background, it may try to give too much exposure in an attempt to lighten the scene. So the subject tends to be washed out, particularly if it is not central in the frame.

Night shots tend to look under-exposed, even when they are not, because of the dark background and the lack of fill-in tones. So the only way to be certain of your results is to carry out a trial outdoors at night, using an average subject. Then you can compensate for under- or overexposure in future when choosing the aperture which the flash recommends.

Faced with the problems of uncertain subject brightness and limited flash range, it is tempting to ignore the auto

Disappearing trick *Although exposure here is correct, the dark clothes and hair have merged into the background*

sensor altogether and use the unit manually. This can also lead to problems, but usually the results are more consistent, though underexposed. The guide number and table of recommended apertures are worked out on the basis that the flash will be used in average conditions, with walls and a ceiling to reflect some light. Outdoors, however, up to a stop extra exposure may be needed. Again it is best to experiment with your unit, so that when you need to use it outdoors you can give the correct exposure.

A common outdoor problem is that foreground objects may be very over-exposed. One solution to this is to use a neutral graduated filter over the lens to cut down the foreground brightness, either with the darker half at the bottom or to one side, depending on the picture.

Using available light
Streetlights, bright windows and doors may not give enough light to take pictures by, but often they give enough to pick up the all-important edges of the subject. You could, for example, silhouette your subject against an open door and fill in the detail with flash. With fast film there may well be enough light to do this at the normal flash shutter speed and full aperture, but often you will have to give a rather longer exposure, either because the available light is too dim or because your flash requires a smaller aperture. In this case a tripod is needed, though in some cases a hand held exposure may work—the edges of the flash light area will simply be a little blurred. And if your subject moves during the long exposure, the result will be a dark streak with the sharp flash image within it.

Such a technique can also be used to good effect during twilight. Even if the sky is not bright enough to be properly exposed, it can still give sufficient illumination to outline your subject.

Flash off the camera
If you only have one flashgun you can avoid some of the problems of front-lighting by taking the flash off the camera. You can get some dramatic lighting effects by putting the flash right around to one side, so the subject seems to be illuminated by a floodlight. You could even move the flash behind the subject to give rim lighting—though this will give no front detail.

With the flash on auto you will not need to adjust the exposure. Though the overall illumination of the subject may

Jerry Young

Plane sky *Shooting at dawn or dusk gives you a sky which is just bright enough to outline the subject*

Against the wall *Although the background is underexposed, it still helps to give shape to the subject*

George Wright

be less, the parts that are lit will be exposed properly. The shadows will come out black. And with the rimlight it does not matter much what aperture you use—the only effect will be a brighter or a dimmer halo.

If you are using the manual settings on your flash, you only have to concern yourself with the distance between the flash and the subject. Once the subject is correctly exposed it does not matter how far away you shoot it from. This only affects the area exposed on the film—if you are very far away the illuminated area will be rather small in the frame but will be correctly exposed.

Bright face *Giving one stop more exposure brings out the clothes and hair but overexposes the skin tones*

Manual mode *Using the guide number method results in underexposure due to the absence of reflecting surfaces*

Jerry Young

The best location for your main flash is probably the classic portrait position, above and to one side of the camera, though this depends very much on the nature of the subject. With just one secondary flash you can add light to one side, which will give a bright sheen to that side, or you can put the light above and behind the subject. This will tend to create a misty blue beam in the air, while any light behind the subject will give rim lighting. Alternatively, you can illuminate the background to the subject, to avoid the subject's edges merging into the darkness.

For side and rim lighting, you need not worry unduly about the subsidiary flash's output as far as exposure is concerned. Rim and side lighting is expected to appear overexposed, so a stop or two either way has little effect on the final result. But if any two flashes overlap, some calculation or even guesswork will be needed. Remember that if two flashes with the same setting are combined you should reduce the exposure by one stop.

If you have four flashguns you can fix them up at the four corners of the area you want to work in, using tape or elastic bands to attach them to trees, lamp posts or, if you are in a building, to the walls. Point them all towards the centre, but point the slave units at the triggering flash so that when it goes off, they all do. Some slave units are not very sensitive and need to receive a lot of light from the

Flash bike *Having the flashguns separate to the camera enables the photographer to move around without changing exposure*

Inside light *You can use available light to give a background and still use the flash on automatic*

Tree light *This shot used two flash units—one at the portrait position and one behind the tree to give sidelighting*
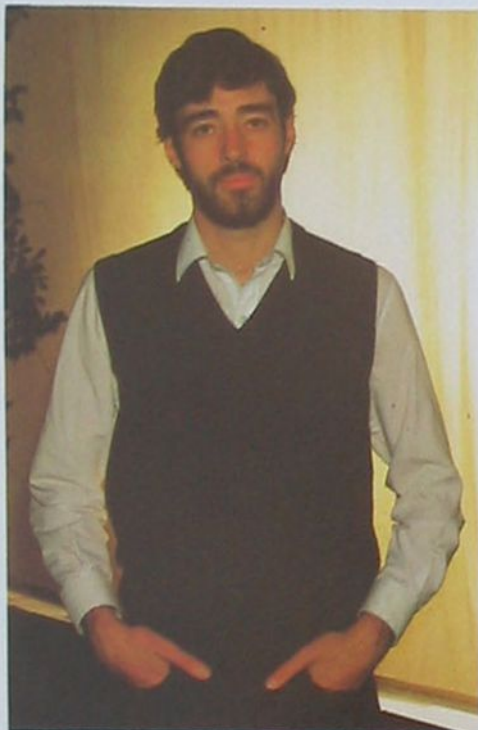
Multi-flash

Some of the most interesting effects using flash at night are produced by several flash units working together. The units may be linked using sync leads and multi-way adapters, which can mean long lengths of cable. Alternatively, you can equip each subsidiary unit with a slave cell (see page 1083). The main flash unit is triggered by the camera shutter in the normal way, and the other units then fire simultaneously. The flash units need not be very powerful—small units can be bought very cheaply, and are ideal for such use.

The triggering flash can be your main unit, either on or off the camera. It can even be the built-in flash of a pocket or instant picture camera. You may wish to soften and reduce the light output from this by taping a paper handkerchief over it, so that the resulting picture will not appear strongly front lit.

George Wright

main unit.

Now you can move around freely taking pictures in any direction, with every one well lit. You are guaranteed backlighting to separate every shape from its background, pick up texture and highlight smoke or steamy breath. As long as you do not shoot with your back too close to any of the units they will not over-light the subject—the autocell on the main flash should automatically compensate for light from the secondary units.

If any of the flash units are in the picture, the results may still be attractive. They will give some flare some burnt-out areas, just as you would get from street lights or other 'natural' night illumination.

Painting with light

Another way to get the flash off the camera is to put the camera on a tripod, lock the shutter open on the 'B' setting and go for a walk round the subject, which must be stationary, firing the flash again and again at different parts. This 'paints' in the picture area by area and is much easier to do than it sounds.

As long as you only fire the flash once at any given point on the subject you can use exactly the same setting as for normal flash. The autocell will adjust the output to give each part the same illumination, or you can fire the gun at the same distance from the subject each
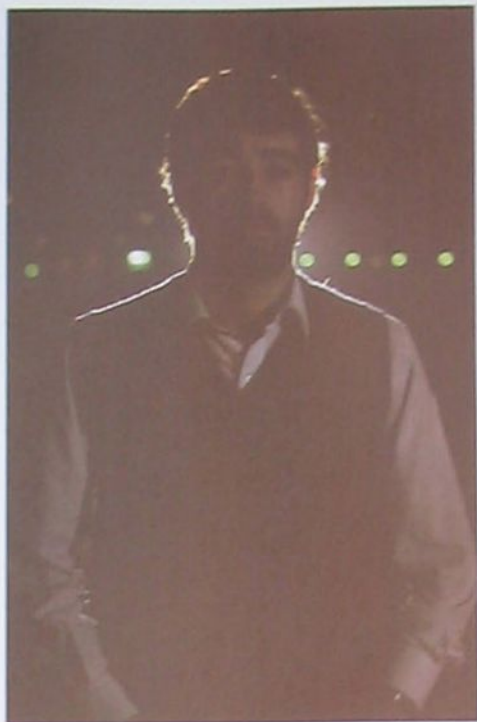
Just rim lit *The flash used to give rim lighting can be read by the sensor on the main gun, giving underexposure*

Flash painting *This shot was lit by 15 separate flashes, while the shutter was kept open for three minutes*

time. You can backlight, frontlight and sidelight the same object with a single flash unit in this way. Or you can fill in a whole nearby landscape piece by piece. It does not even matter if you stand in the frame, as long as you are not silhouetted by the flash and you do not get your feet in the way. If no light falls on you, you will not appear in the picture.

If the flash is pointing towards the camera and is in the frame there will be flare, which you may or may not want. And if a figure moves every time the flash is fired their image can be laced through the landscape. All you are doing is building up a single picture from a number of different exposures.

Alternatively, you can fire the flash twice at each part and stop down the lens one stop to give a greater depth of field. If you fire the flash four times you can stop down two stops, eight times and stop down three stops.

Standing closer to the subject with the flash will give a smaller pool of light of course. But if you want to light something big, evenly, like a building, you may have to stand well back and fire repeatedly. If you are back beyond the auto range of your flash you will have to calculate the exposure as before.

As using a long exposure is inevitable, you can add tracer effects from the tail lights of cars, torches, fairground lights, or even fireworks to trace out shapes with light.

Reviving old processes

With a little practice most of these old processes can be mastered quite quickly. The results are fascinating and thanks to modern papers and chemicals, often more permanent than the originals

As well as giving you an opportunity to try out something a little different, experimenting with old processes gives you a chance to get to know some of the photographic properties of different types of sensitive emulsion. Although the results rarely compare with those obtained by more modern processes, the prints have a charm of their own.

Most old emulsions were very slow, and those discussed here are no exception. So you need to make large size duplicate negatives ready for contact printing. A hinged contact printing frame would be useful, to allow inspection of the printed image from time to time during exposure.

Manganese lactate
This process does not involve expensive or toxic chemicals and the coloured images which result are extremely long-lasting. To prepare the emulsion coating, dissolve 5.7 g of potassium permanganate in 50 ml water and stand the container of this solution in another larger vessel of cold water. The cold water is essential because the next step involves running 14 ml lactic acid into the solution one drop at a time down a glass rod. Great heat is generated when the lactic acid meets the permanganate and the solution bubbles strongly—so you must add only one drop at a time and mix it in before adding the next drop. When all the lactic acid has been added and mixed, and all the bubbling stops, you are left with a thick brown liquid. Add the final component, which consists of a solution of glucose you make by dissolving 4 g glucose in 15 ml hot water, left to cool, and filtered through cotton wool or muslin prior to addition. Do this in subdued lighting and a properly ventilated working area.

For the base use quality *virgin* wove paper, similar to that used in calotypes but much thicker. Apply the emulsion coating in subdued lighting, using a soft, broad-headed camelhair brush or something similar. The more even and smooth that you can make the coating, the better the result. You may find it easier to give two very thin layers rather than one thicker one, working first in vertical strokes to cover the paper and then horizontally to smooth the emulsion. Do not let any sensitizer spill on to the back of the paper or stains will result. Let the paper stand for half a minute to allow the coating to sink in, then blot off the excess. Leave the sensitized paper to dry in the dark. To make full use of the emulsion you have prepared, prepare several sheets and store them in darkness ready for exposure.

The manganese lactate process is

Boats *Old processes can often give a unique and startling effect, such as the rich tones of this albumen print*

Pauline Gentry

Albumen printing-out paper

1 *You will need about seven eggs to give you 170 ml of albumen. These should be broken into individual containers to avoid contamination*

2 *Mix the albumen, rectified spirit and sodium chloride solution, then whisk for 15 minutes before leaving to stand overnight*
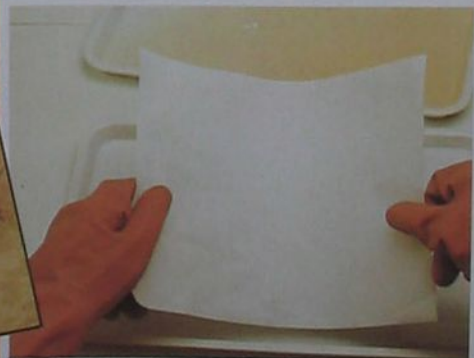
5 *Float the paper on to the albumen solution for about a minute, bringing the centre of the paper into contact first. Then leave to dry naturally*

6 *Float the dry albumen paper for three or four minutes in the silver nitrate solution, then dry. Beware of scorching the emulsion if heat drying*

Robert Hurst

courtesy of the Kodak Museum

Kallitype *Modern acid-free papers give more permanent results than the originals, which tended to deteriorate as a result of the chemical by-products of the process. As with the Van Dyke process, the sensitizer is a mixture of ferric and silver salts, but with the Kallitype process there is a choice of three different developers, each giving a different image colour. For the example on the right a bold, contrasty negative was used to give blue–black tones on good quality drawing paper, sized with spray starch*

The sensitizer is mixed under yellow safelighting using 50 g of ferric oxalate, three grams of oxalic acid, 25 g of silver nitrate, dissolved in distilled water to make 300 ml of solution. For the blue–black tone developer, used in the example above, use 24 g of borax, 90 g of Rochelle salt and 1.5 g of potassium dichromate with distilled water to make 950 ml of solution. Development time is five minutes. For the fixer 50 g of sodium thiosulphate are dissolved in hot water and when this has cooled 12 ml of a 0.88 concentration of ammonia is added and made up with distilled water to give a one litre solution

3 *After the albumen solution has settled filter it through some cotton wool. The cotton wool should first be rinsed in distilled water*

4 *Once the albumen solution has been filtered, pour it into a flat bottomed tray or developing dish. A large plate will do for this if the prints are small*

7 *After exposure, immerse the print in a solution of 60 grams of sodium thiosulphate dissolved in 500 ml of water for three or four minutes*

8 *To give a stippled, semi-matt finish as opposed to glossy, hold the dried albumen print over the spout of a steaming kettle to coagulate the emulsion*

unusual in that it provides a positive image from a positive original, so enlarge your negatives on to a film like Kodak Gravure positive 4135 to get a suitable black and white transparency for contact printing. On a sunny day, exposure times should be between 4 and 15 minutes. Examine your first test after, say, 10 minutes. If everything is going well, you should notice a thin negative appearance as well as a heavier positive image on the brown coating.

The image can be developed in a range of different solutions. A saturated solution of aniline sulphate gives a green-coloured positive image. Adding a few drops of ammonia to this gives a violet-coloured result. With orthotoluidine sulphate and a few drops of hydrochloric acid, a deep blue image results. For a 'normal' image tone, use a solution of paraminophenol.

Development takes about 30 seconds and has the effect of bleaching areas exposed to light, while colouring the remaining parts. No fixing or clearing is necessary, and, after a vigorous five minutes wash in running water, your manganese lactate print is ready for drying.

Albumen paper
Albumen printing out paper was very much in vogue at the turn of the century as it was—and is—simple to prepare, and needs no development, only fixing. It is an ideal way of duplicating the effect of original albumen prints which have been copied on modern films to preserve the image (see pages 2470 to 2473). Any good quality acid-free, ready sized paper can be used for the base. The emulsion is prepared by first

courtesy of the Kodak Museum

Cyanotype This is also known as the blue-print process, as it gives a white image on a blue background, and was perhaps the earliest forerunner of modern photocopying. However, because there is no effective fixing process, the results tend to fade if exposed to bright light, and so there are few good examples of surviving originals. A hard, contrasty negative was used to give the example on the right. Because there is very little tone range in a cyanotype, most of the whites are tinted blue by the process

The sensitizer is a mixture of two solutions which should be kept in separate dark bottles when not in use. For the first solution dissolve 68 g of ferric ammonium citrate and 1.3 g of oxalic acid in 250 ml of distilled water. For the second solution dissolve 23 g of potassium ferricyanide, 1.3 g of oxalic acid and 0.5 g of ammonium dichromate in 250 ml of distilled water. These are mixed in equal quantities and coated on to sized paper. Exposure should be done under ultraviolet light from a sun lamp or tube. The paper is processed in changes of cold water, to remove the yellow stains of the sensitizing chemicals

Manganese lactate printing

1 Dissolve 5.7 grams of potassium permanganate in 50 ml water and stand in a large container of cold water. A jug will do for this

2 Add the lactic acid, a drop at a time, to the potassium permanganate solution down a glass rod, and mix thoroughly before adding the next drop

3 Great heat is generated when the lactic acid is added and the solution bubbles strongly. A fume mask may be necessary for this step. Alternatively, work outdoors

7 Coat the paper smoothly and evenly under subdued lighting, with a soft brush. Gloves should be worn during this step to avoid staining your hands

8 Next, leave the paper to stand for half a minute, and then blot to remove the excess. The paper should be left to dry in the dark

9 Expose the paper for between four and 15 minutes in direct sunlight using a black and white transparency prepared from the original negative

dissolving 43 g sodium chloride (common salt) in 50 ml distilled water with 6 ml rectified spirit (ethyl alcohol). Then add 170 ml pure albumen. You can obtain albumen very easily since it is the greatest part of egg white and each egg has on average around 25 ml albumen. Use free range eggs because battery hens are fed a variety of chemicals that render their eggs unsuitable for photographic use. To separate the egg whites use an individual cup for each, thus preventing contamination of the whole mix in the event of one yolk being broken. Remove the germ of each egg as well.

Whisk the albumen, spirit and brine solution for 15 minutes and stand for 24 hours. When this has settled, rinse some clean cotton wool in distilled water and then filter the beaten albumen solution through it. Now pour the filtered solution in to a flat-bottomed tray—a large plate will do. Float the sheet of paper to be coated on the top of the solution. To lessen the risk of airbells, let the centre of the paper come into contact first. Carefully lift it away after a few seconds and wet any dry patches with a camel-hair brush. Return the paper to float in the dish for about a minute more, remove it and then set it aside to dry. While the emulsion is drying, prepare a solution of 4 grams silver nitrate per 30 ml distilled water in another flat tray or plate. Float the dried albumenized paper on the silver nitrate solution for between three and four minutes, in darkness or very subdued lighting, and then lift it away and dry naturally without heat.

Expose the paper in a contact frame on a bright sunny day—an overcast day will do if the light is sufficiently bright. Exposure times will vary but try ten minutes to start with and make a number of tests. Note the image build-up carefully during the course of the exposure and aim for a time where the image is just darker than needed.

When the density is right, take the frame indoors and remove the print. Wash it first in distilled water for five minutes with vigorous agitation, and then in tap water for ten minutes. While the print is being washed, prepare a plain non hardening fixer bath by dissolving 60 g sodium thiosulphate in 500 ml water. Add two or three grams sodium carbonate to make the fixer slightly more alkaline. Immerse the print in this for around three or four minutes. You may find that a little of the density is removed in fixing, and this is the reason for overexposing slightly. Now repeat the

Manganese lactate *This process gives fairly permanent results and different image colours depending on the developer*

John Ward

4 *The glucose solution is prepared by dissolving four grams of glucose in 15 ml of hot water. Leave this to cool then filter through cotton wool*

5 *Mix the glucose solution with the manganese lactate solution, in a well-aired room under subdued lighting as the mixture is sensitive to light*

6 *If the manganese lactate solution is too gritty then it may be necessary to give it an extra filtration through cotton wool or muslin*

10 *During exposure, examine the image after, say, ten minutes. If all is going well a thin negative appearance will be seen as well as the heavier positive*

11 *Develop in a saturated solution of aniline sulphate which gives a green image. For a violet image, add ammonia. Use these two solutions with care*

12 *Development takes about 30 seconds, after which you should wash the print for five minutes in running water and then dry it*

Robert Hurst
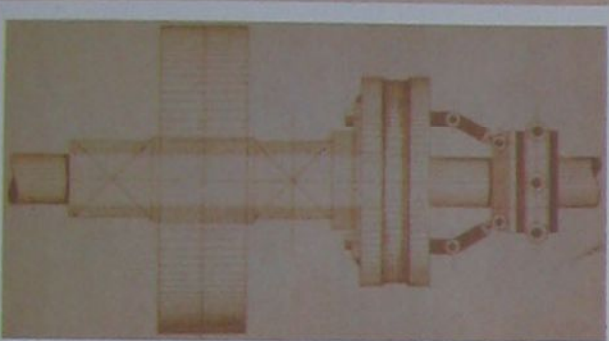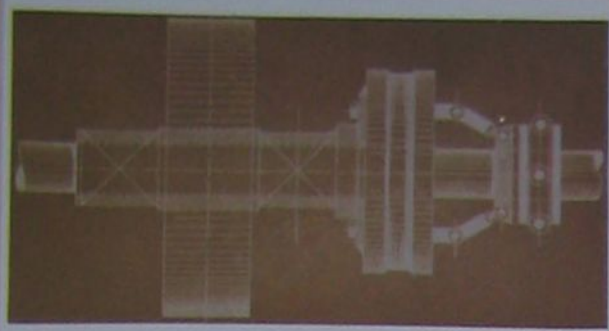
Van Dyke brown *This process gives a soft, delicate effect because the maximum image density is low. The image appears to be dyed into the base material and this is because the silver salts used in the sensitizer merge into the base, rather than lie on the surface as with a conventional photographic emulsion. Either paper or fabric can be used as a base material, but choose a texture to suit the image you wish to print. For the best results use a high contrast negative, as in the example shown on the right*

There are two different sensitizing solutions for this process, one giving a dark brown image colour and the other a sepia-brown colour. For the dark brown sensitizer dissolve 30 g of ferric ammonium citrate, ten grams of silver nitrate and five grams of tartaric acid in distilled water to make a 300 ml solution. Develop this for ten minutes in warm running water. For the sepia-brown sensitizer dissolve 25 g of ferric ammonium citrate, four grams of oxalic acid and ten grams silver nitrate in distilled water to make a 300 ml solution., This should be developed in a one per cent borax solution. Plain hypo fixer is used in both cases

wash steps and your print is complete. To add real period character you may like to gold tone your prints (see pages 1922 to 1924). This also improves long term permanence.

Another variation is to double albumenize the paper before sensitizing it. This will give you a semi-matt, stippled finish instead of comparatively glossy finish normally obtained. The first coating uses an emulsion obtained by beating a mixture of 170 ml albumen with 20 ml rectified spirit and 40 ml distilled water and coating it on the paper by the floating method. Leave it to dry and then hold it over the spout of a steaming kettle. This coagulates the albumen, which clumps together to form a stippled emulsion. Let the paper dry and then give a second coat using the normal salted albumen emulsion.

Old salt processes

A cyanotype (c. 1842) is often called a *blueprint* because of the white image on a blue background which is obtained using the process. It is one of the simplest, quickest and cheapest methods of recording a line original. From an early date, it found favour in engineering and architecture for copies of drawings and plans. The process only works well with very bold, contrasty originals. The cyanotype is an *auto-negative* process which gives a positive from a negative and is a member of the vast iron salt family of processes which includes platinum and Pellet's process (an *autopositive* version of blue printing). Many of these iron salt processes can be used for printing on a wide variety of papers and on fabrics ranging from cotton to canvas.

To make a blueprint you coat your paper with mixtures of solutions based on potassium ferricyanide and ferric ammonium citrate (see panel) and left to dry naturally. The dried material is then exposed in contact with a contrasty negative. As with all these processes relying on contact printing, exposures should be made with a UV lamp, or in bright sunlight. Exposed areas of the cyanotype turn bright blue. No development is needed but several washes are needed to remove the yellow–orange or greenish–yellow emulsion areas that have not been exposed, leaving white or the base colour. The last wash must be slightly acidified with a few drops of hydrochloric acid to act as a 'fixer' bath which also improves the image 'whites'.

Pellet's process (c. 1880) involves coating the paper with simple solutions of gum arabic, ferric ammonium citrate and ferric chloride. When exposed in contact with a transparency, it gives a positive yellow image which turns blue on 'development' in a solution of potassium ferrocyanide. This is a potentially dangerous chemical which must be handled and stored with extreme caution, so the process is not one for casual experiment—and should be used only if you know precisely what to do.

The *Van Dyke 'brown print'* and *Kallitype* processes are based on the use of a combination of iron and silver salts (but consider the cost of the latter). The Van Dyke process can only be used to produce a limited range of tones in either a brown–black or warm brown colour, depending on the sensitizer formula used (see panel). This should be prepared using a fairly coarse-textured paper—or even fabric—for the support, which must be coated in safelight. After exposure, using contact printing methods and UV light source, the image is developed either by washing the print or by immersing it in a weak borax solution. A simple fixer bath and wash then follows.

The Kallitype offers a choice of three image colours, depending on which developer you use. The sensitizer contains a large amount of expensive silver nitrate (see panel). Mix and apply this in safelight conditions on paper or fabric which has been sized and dried. It is best to use bold, contrasty negatives.

Development is in solutions of borax, Rochelles salts (sodium potassium tartrate) and potassium dichromate. Fixing is in plain sodium thiosulphate made alkaline with a small quantity of ammonia (see panel).

Palladium printing is an iron salt process and is almost identical to platinum printing (pages 2360 to 2363) except that the platinum solution in the formula (solution B) is replaced by a solution consisting of 5.2 g potassium chloropalladite dissolved in 25 ml distilled water. Prints for the palladium process need slightly more exposure than given for platinum.

When development is complete, rinse the print in a very weak (half percent) bath of hydrochloric acid and tap water. Leave the print in this for about five minutes and then pass it through two successive baths of the same strength, for the same duration. Then wash the print thoroughly before leaving it to dry.

The palladium process does not offer quite the same degree of contrast control (obtained by adjusting the ratio of the three solutions used in platinum printing) so it is best to stick to the normal ratio.

Mountain scenery

Although they are generally very picturesque, mountains can be surprisingly difficult to photograph. Here, John Sims describes some of the major pitfalls

This picture, taken from an aircraft, has a pleasing feel to it, due mainly to the monochromatic quality created by the blue light present at high altitudes. Unfortunately, the mountains themselves get a little lost in the haze. A lower sun would bring the mountains into greater relief and provide more graphic content to the picture as well as providing increased contrast between the outlines and the varied forms of the clouds. The small amounts of snow on and around the peaks would also stand out more when lit by the lower angled rays.

Problems of scale, contrast and weather conditions make mountains and mountain scenery difficult to photograph well. The subject here looks promising, but this shot, taken with a high sun and from eye level lacks interest. There are no dynamic lines or points of focus, and the colours are rather weak. I would suggest waiting for the sun to sink much lower in the sky, even slightly below the horizon, to allow the face of the cliff to stand in relief, and then to lower the position of the camera to the level of the rocks in the foreground.

Of the three examples, this for me provides the greatest number of compositional possibilities in terms of both the camera position and the camera/lens combination. My main concern would be to accomplish as much as possible before the light disappears totally. Initially I would concentrate on the left-hand side of the picture, eliminating as much of the leafless tree as possible and emphasizing the silhouette of the hut against the distant peaks. The dark zone, created by the outline of the hut, helps to strengthen the pink and mauve colours of the late evening sky. Since the framing is so important I would use an 80–200 zoom to eliminate the need to change lenses and waste time. With this same lens, or a longer focal length if available, I would then concentrate on the subtle tonal relationships between the peaks and the sky without any reference to the foreground. Finally, I would return to a similar framing to that in the example. Clearly, in all of these situations, the camera should be mounted on a firm tripod since most of the exposures will be under 1/125 second. In nearly all cases I advise bracketing the exposure by at least one stop either way and also, whenever the foreground is included in the shot, I would stop the lens down to ensure that all the elements in the picture are as sharp as possible.
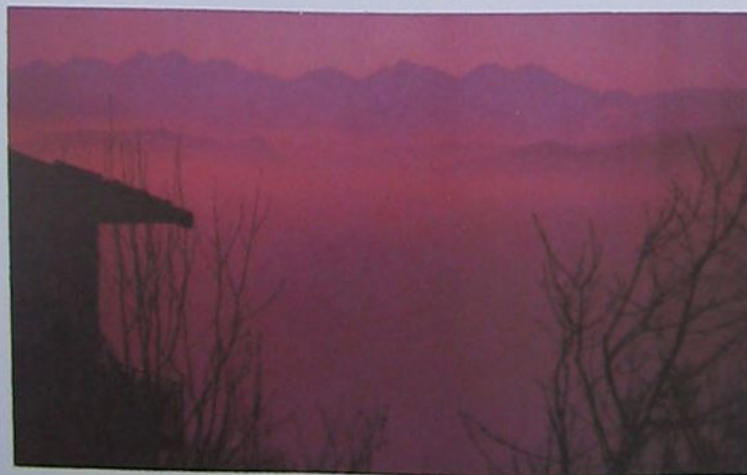
FAST FILM at NIGHT

Colour photography after dark usually means flash. But Chris Steele-Perkins tried to get more natural results when photographing a fairground by using fast colour film, 3M's 640T

Over the least few years film manufacturers have made great strides in increasing the speed of colour transparency films. 400 ASA films are now available from various manufacturers and, with push processing, it is possible to get usable results up to 800 ASA. Until recently, however, tungsten-balanced films had lagged behind. Now 3M have introduced 640T—a tungsten film with a nominal rating of 640 ASA which, at a push, can be used at up to 1280 ASA. To test its performance in extreme conditions we asked Chris Steele-Perkins to take a few rolls to Copenhagen.

As a photojournalist, Chris habitually uses fast black and white films in poor natural light, but in similar conditions with colour he is usually forced to use slow films with flash—a combination

Reflections *The film has given good rich colours in the reflections of the street lights offset nicely by the clean white of the tubes. Grain, though large, is not too distracting*

Photographer *The low contrast of 640T, characteristic of high speed transparency films, has given a soft image in keeping with the subject. Flesh tones are reasonably good despite the difficult lighting*

Chris Steele-Perkins/Magnum

Shoe shop *3M recommend that you should not attempt to push 640T more than one stop though, as the film uses standard E6 processing, it is possible to experiment. These shots show that, where possible, 3M's advice should be heeded. The shot above, at 640 ASA, has a good range of clean, accurate colours. At 2560 ASA, not surprisingly, grain is increased, colours are poor and the overall effect is muddy with a complete lack of shadow detail (below)*

Kiss *Chris was amused by the way the smiling statue appeared to be watching the lovers. Although the shot appears to have an orange cast, this is due to the coloured fairground bulbs. White bulbs in the background are accurately registered*

Fellow travellers *Chris took this double-portrait on a tram. With any other film, a flash would have been needed to gain a sharp exposure despite the tram's movement, but flash would have turned a pleasantly-modelled portrait into an unattractive snap*

Chris Steele-Perkins/Magnum

Theatre *The fast speed has allowed both a high shutter speed to prevent blur and a small aperture to keep both scenery and actors sharp. Fine detail is well resolved and the overall colour is rich and well-saturated*

which he does not really like because it gives rather clinical, unnatural results and can distract the subject.

The first thing that struck Chris was the degree to which fluorescent lighting has taken over from tungsten, making true tungsten lighting rather rare. Nevertheless, he shot a series of photos in and around a Copenhagen fairground using an Olympus OM-2 and, for most shots, a 35 mm lens at or near its maximum aperture of *f*/2.

Overall, he thought the film performed quite well, with reasonable sharpness and grain size, considering the speed, and generally pleasing colours. The most satisfactory shots were taken under strong stage lighting at the open air theatre—at lower light levels, the colour cast seemed a little suspect, with blacks having a tendency to green.

The quality was not quite good enough to displace slow films altogether and Chris felt that if he were on a similar assignment he would like to have two camera bodies, using slow film and flash for some situations and 640T where flash would be a distraction, or where the harsh lighting would be innapropriate.

On the whole, Chris felt that 640T is a useful addition to the photographer's bag, even if only a couple of rolls for situations where its special qualities are at a premium.

Gamblers *A single bright light in dark surroundings gives very high contrast—a difficult situation for any film—but 640T has performed commendably. Good detail has been retained in the poorly illuminated faces while the players' hands have not burned out. Use of flash would have destroyed the intimate atmosphere which gives the shot much of its appeal.*
Faces *Pushing the film to 1280 ASA (below) has given a marginal increase in depth of field. Although grain size has increased slightly the overall effect is virtually indistinguishable from the standard rating (right)*

clean skin and no make-up—especially no mascara. Mascara is very difficult to get off and thick, clogged eyelashes can easily ruin a natural looking shot

If at all possible you should have a mirror in the changing room with lights on three sides—left, right and top. The lights should be alternately daylight bulbs—specially made to match daylight, but with conventional domestic fittings—and ordinary pearl bulbs. If you have no space for a changing room it is possible to make up in available daylight. And if the shots are to be taken outside it is best to make up in daylight.

Foundation and colour

Applying make-up takes skill, and, if you do not have the skill, it is best to leave it either to the model or to someone who is accustomed to handling make-up. What follows is a guide to anyone with a basic understanding of make-up procedures, rather than an introductory course for beginners. Use of make-up for photographic purposes is not restricted to women, though inevitably it is more likely that you will be making-up a female model. The same basic principles apply to men, particularly where blemishes are to be removed, though the work must be done more subtly. The procedure is described for people with Caucasian skin colouring, but a wide range of products is available for other skin colours.

To begin with you should tie the model's hair back. For natural looking 'pretty' make-up for a beauty shot choose a foundation that will match the model's natural skin tone, taking the colour from the tone of the neck rather than the face.

Foundation can either be pancake or

Robyn Beeche

PHOTO MAKE-UP

Knowledge of make-up techniques is a useful asset for many types of photography—from fashion to portrait. Here are some tips and guidelines to show you what make-up can do

In fashion and beauty photography, make-up plays a vital role. It is not something that can be left to chance or the whim of the model. It has to be considered as part of the overall artistic effect of the photograph. Good make-up can make all the difference between success and failure with this type of shot.

If you get a friend to do the make-up you must brief them. They will need to know not just what effect you are trying to create, but also whether the shot is a close-up cropped at the waist or full length. All this determines how the make-up is applied.

For a beauty shot, a model with good skin is preferable. But a covering foundation, strong colours and over-exposure can work wonders. However, if a very natural look is required and the shots are going to be taken outside, smooth skin with no lumps and bumps is essential.

Always ask the model to arrive with

The toolkit *For greatest flexibility you should have a wide range of make-up and accessories, such as brushes*

All photographs by Wayne Günther

1

2

3

4

1 *The first step is to apply the base. Take the colour for the foundation from the neck rather than the face. After applying foundation all over the face, use powder to set it. It is important to get a good matt finish*

2 *Intensify the brow bone with a dark shade under the eyebrows and a light tone just on the brow. A small amount of light eye shadow on the lids acts as a basis for the main colour (which should be slightly paler than the skin tone)*

3 *Further intensify the eyes, adding colour to suit. Place the emphasis on the outsides of the eyes. Apply blusher to the cheekbones with a large, soft brush. Always blend colours to avoid harsh edges between one tone and the next*

4 *The soft, smudged effect on the eyes is achieved using a kohl pencil and blending it in. Eyeliner has been used, though not right across. The last thing used on the eyes is mascara. Blusher and lipstick are then added*

The final effect *You can see how the make-up colours, which include browns and golds, have been chosen to suit the colours in the clothes*

oil-based. Pancake, which is mixed with water and applied with a sponge, tends to be better for oily skins while oil-based foundation is better for dry skin. But there are no hard and fast rules.

Unless the skin is very dry do not put a moisturizer on first as this makes the skin more shiny. Use the back of your hand as a palette—this will help you not to put too much on. With your fingertips or a sponge, apply the foundation to the face in sections, starting with the cheeks and forehead. Stroke downwards in the direction of the hairs of the face or you will tend to get a matted and over made-up look. Stipple a little extra foundation over broken veins or blemishes. Always apply foundation in thin layers.

To add colour to the face use powder blusher. This is easier to apply than creams or gels. The colour of the blusher should be determined by the rest of the colours in the shot. Fill the blusher brush with powder, tapping off the excess on the back of the hand. Then get the model to smile and apply the blusher to the

All photographs by Wayne Gunther

Without make-up *The model's skin is very smooth and clear. It is best to aboid using moisturizer unless absolutely essential because it makes the skin shiny. As the model's skin is fair, a pale base is used*

The foundation *The model is going to wear a low-cut dress, so the base is taken down on to her shoulders. Blend with a sponge as this also takes up any excess, then powder to set the base*

The eyes *The eyebrows have been brushed upwards to enhance the shape of the face. The pale skin allows the use of softer colours. Blue and pink eye shadow were used to complement the eye colour*

Finished eyes *The mascara is added last to avoid smudging it. The lashes are brushed upwards to accentuate their shape. Blusher is applied next to enhance the shape of the cheekbones*
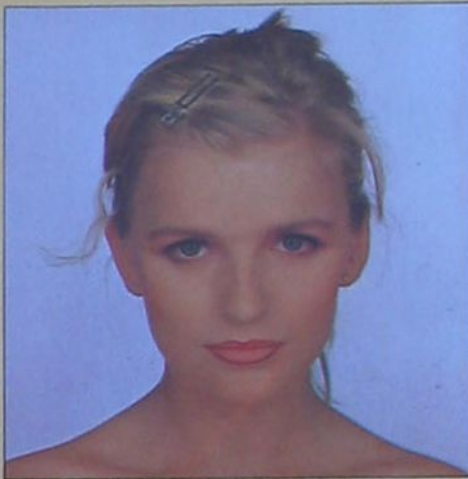
Lip lines *The lips are outlined in a dark colour. Be careful not to go too near the edge, or the colour will bleed on to the surrounding skin. A lipstick pencil is ideal for this purpose*
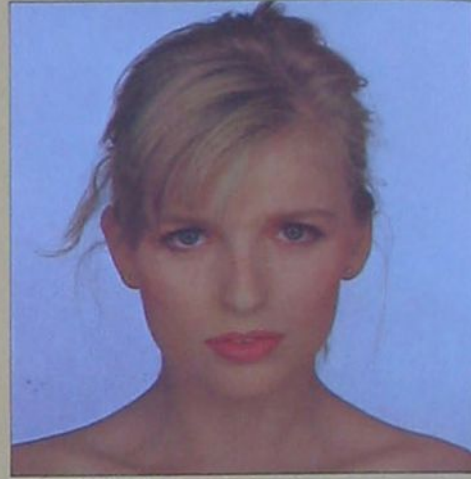
Full lips *Smudge the outline inwards and fill in with a lighter colour, using a lipstick brush. Finally, apply powder to set the make-up. This keeps it in good conditions for at least a few hours*

cheekbones from just below the middle of the eye out towards the hairline.

Face powder is used to set the make-up, reduce shine and give the skin a natural, smooth, dry matt look. Always use transparent powder. Coloured powder reacts with the foundation and the oils in the skin to produce a nasty orange colour. Fill a powder puff or cotton wool ball with powder, using the upturned palm of your hand as a powder bowl, then press it to the skin. Remember that you are setting the make-up so do not scrub or you will move the carefully arranged make-up. If you have no face powder, use baby powder.

Eyes

Bright coloured make-up is harder to work with than browns or greys. And for a natural yet made-up look, muted tones sit better around the eyes. Apply eye shadow over all the area from the lashes to the eyebrow, fading it out towards the brow and blending it in well at the edges. Some eye shadow can also be

applied underneath the eye and a good rule of thumb is to take the eye shadow down as far beneath the eye as the bottom lash extends.

To add extra sparkle to the eyes choose a white frosty shadow, close the eyelid and apply a small triangle in its middle. Then add a 'V' of white around the inner corner of the eye and blend both in.

If the model has very fair lashes which do not show up well in photographs they can be dyed. Otherwise they can be emphasized by drawing a very fine line around the eye at the base of the lash with a dark liner, carefully using the edge of the brush.

To give the lashes a natural look apply several thin coats of mascara. Always wipe the brush on a tissue first to blot off any excess mascara that would otherwise clog the lashes. If you are taking a very close up shot and the lashes are dark it is often better not to apply any mascara at all.

Eyebrows should be brushed upwards

with an eyebrow brush and any gaps filled in with an eyebrow pencil applied in fine, feather-like strokes. Each eyebrow should start directly above the inner corner of the eye. To find where it should end, take a pencil and lay it flat to the face so that it runs from the side of the nose to the outer corner of the eye. The eyebrow should end on the extension of this line.

Lips

Most people have uneven lips, but the shape can be corrected by drawing an outline using a lip liner pencil of the same colour as the lipstick you are going to use. The pencil should be a toning pencil which is easy to blend, otherwise the line may be too obvious.

The lip shape should then be filled in with colour. Lipstick should be applied with a brush and it should never be taken right up to the edge of the lips. Everyone has minute cracks around their lips and lipstick taken to the edge will leak down the edges on to the surrounding skin.

Hiding imperfections

Few of us are perfect and in this respect models are no different—it is often the ones who arrive looking really awful that are the most photogenic.

Dark shadows under the eyes can be hidden with a fine textured under-eye cover cream. Warm this between the finger and thumb before use. Stipple it lightly with your fingers over a thin layer of foundation. Cover with another layer of foundation and blend carefully.

A lot can be done to cover up puffiness or bags under the eyes with good lighting, but make-up can help too. Use a very fine eyeliner brush to paint a light-coloured under-eye cream along the dark line around the bag. The light colour will bring the dark line forward, but do not apply it to the puffy area or this will make it even more prominent. Blend it in carefully and cover with foundation. For bloodshot eyes use eyedrops.

Wrinkles and crow's feet can be tackled with soft focus or you can use a fine textured foundation and the finest translucent powder over the problem area—anything heavy or shiny will accentuate the wrinkles.

To disguise a heavy jaw or a plump face use a brownish coloured powder shader to deepen the area you want to recede. For black and white shots you can even use black to shade these areas. It is often a good idea to shade underneath the jawline anyway.

To tone down high colour in the cheeks use a flat beige foundation, one that contains no pink. Lots of thin layers stippled on should do the trick.

Body make-up

If you are attempting glamour photography, especially in colour, it is best to use a professional model. They tend to take good care of themselves and their body skin, and they normally have an all over tan. This eliminates the problem of covering up bikini marks which even for the professional make-up artist is a difficult task.

Bikini marks can be disguised,

Fully styled *Having seen the dress and necklace, the make-up artist then intensified the colours to stop the face looking pale against the clothes*

however, using a dark brown non-shiny eyeshadow which is closest in tone to most tans. You cannot simply apply foundation—unless you apply it to the whole body—because the paler section you have covered shows up as a different texture from the uncovered skin.

If the model is pale it is possible to produce a very natural looking tan by using a special theatrical powder make-up. This is applied wet with a sponge. Once it is dry you buff it up. But it is very difficult to apply well, it provides no cover for imperfection and never sits well on the skin of the face. Ultimately, the less you have to do to secure a pleasing tan the better. Naturally, in glamour photography skin tones are all important. They should all match, just as the tones of the face and neck should match in fashion photography.

Snapshot cameras

Now that the fully automatic snapshot camera is firmly established in 35 mm as well as various other formats, many amateurs might wish to pack one of these as a convenient or fun camera, but would you be satisfied with the performance?

Dave King

The choice of cameras *available to the casual photographer is varied and large*

Judging by the great diversity of easy to use, pocket sized cameras on the market, and the frequency with which new ones are launched by various manufacturers, there is an apparently insatiable demand for these snapshot cameras. The term snapshot is appropriate, because they are designed primarily for the novice photographer who is content with an image of a favourite subject, whether it be the family, a pet or scenes encountered on tour. But it is not unknown for amateur photographers (who are dedicated SLR users) and even professionals to own and use a snapshot camera. Furthermore,

anyone with photographic experience is likely to be asked to recommend a simple camera for someone. So we set out to discover the attractions of the popular types of camera, and to see what sort of quality could be expected.

Appropriately, snapshot cameras are not complicated with controls and functions, so they are basic in appearance, and are simple to use. They do not have large interchangeable lenses with focusing rings, markings, numerals, filters and hoods. And frequently the camera's only control is the shutter release. Such a basic design is welcoming to the novice, who prefers

the camera to solve the photographic problems, as well as to the more accomplished photographer, who values the compactness and simplicity for non-critical work. For someone going on holiday and packing essential items, and who does not wish to appear an obvious tourist, an unobtrusive pocket sized camera could be the best choice. Only the serious photographer will realize the limitations of such a camera, and be able to decide whether to leave the SLR behind—or take both.

Focusing zones *On the Olympus Trip 35, these are indicated by symbols. The camera has a full range of film speed settings*

Basic types

Snapshot cameras vary greatly in size, complexity and cost. Among the smallest are the Minox and the Cosina, each measuring about 10 × 6 × 3 cm, which is remarkable for full frame 35 mm format. Most snapshot cameras, however, have more modest dimensions, resembling those of a typical 110 pocket camera.

The simplest snapshot cameras have fixed focus—that is, they are focused on the hyperfocal distance so that they give acceptable results from about 1 m to infinity. Their best results are with subjects about 3 m away. This is a little restrictive, so most cameras have focusing controls, either manual or automatic. The manual ones usually have symbols, such as mountains for infinity, a figure for 3 m and a head and shoulders only for 1.5 m, though there is usually a scale in metres and feet available as well.

Autofocus cameras generally focus in zones rather than continuously. The Canon Snappy 50 has just two settings, while the Polaroid 660 has four, for example.

Virtually all cameras have automatic exposure, and with print film there is a considerable latitude to allow for exposure errors. Of more concern to most users is the convenience of flash—some have none at all, while others have built-in flash. These may operate either when switched on only, as in the Canon Snappy; whenever needed, as in the Kodak Disc; or all the time, as in the Polaroid 660. Some cameras have optional dedicated flash units which can be attached if required.

One traditional bugbear of cameras is loading, and some people still ask the dealer to load their 110 camera for them. Roll film and 35 mm film, while easy to load to the expert, cause non-photographers problems, so some cameras have simplified loading systems, and in some cases motorized rewinding. An increasing number of cameras have autowind, so that all the photographer has to do is press the shutter.

Testing the cameras

The acid test for snapshot cameras is whether or not they produce acceptable pictures, and how convenient they are. So we photographed test charts at different distances, and used the cameras to photograph general outdoor scenes to see how they handled. In each case we also photographed a uniform white sheet of background paper, outdoors with even illumination and indoors by the light of the camera's flash only. The purpose of this was to check for *vignetting*—darkening of the edges of the frame. The cameras examined are as follows:

Konica C35. An autofocus, autoexposure 35 mm camera.
Polaroid 660. Autofocus, autoexposure, automatic flash and instant pictures.
Canon Snappy 20. Fixed focus, autoexposure, fixed output flash 35 mm film.
Canon Snappy 50. As Snappy 20, but with autofocus.
Kodak Disc 4000. Fixed focus, autoexposure, automatic flash, small format disc film.
Kodak Brownie. Obsolete (1950s), fixed focus, no exposure control. Uses 127 roll film.
Cosina CX-2. Four position focus, autoexposure, hot shoe.
Chinon Bellami. Variable focus, autoexposure, detachable side mounted flash, 35 mm film.
Balda CA 35. Variable focus, autoexposure, detachable side-mounted flash, 35 mm film.
Olympus Trip. Four position focus, autoexposure, hot shoe, 35 mm film.
Agfa Optima. Variable focus, autoexposure, autoflash 35 mm film.
Minox 35 GL. Variable focus, manual exposure, aperture variable between f/2.8 and f/16, 35 mm film, hot shoe.
Minolta 110. Variable focus, two position aperture, fixed output flash, 110 film.

The results from most of them varied very little. Many were indistinguishable

Instant picture cameras *The Polaroid 660 gives 8 × 8 cm prints, and the Kodak Disc 4000 uses a negative disc having 15 frames, each measuring 8 × 10 mm*

from those taken using the Nikon, except where really close focusing was called for. There were some differences in the amount of distortion at the edge of the field of view, but in most cases this was unimportant and would not be noticed, particularly on a postcard-sized print.

Another interesting point is the importance of the film format. Most of the cameras used 35 mm film, so we wondered if the average user would notice the difference between this and 110 or Disc pictures. We showed them the Disc shots first, and the conclusion was that while they seemed a little fuzzy somehow, they were not bad. The 110 pictures, oddly enough, were judged less acceptable even though the Minolta was a focusing, rather than fixed focus camera. This suggests that the Disc camera's flatter film does improve quality compared with the 110 cartridges. Many non-photographers do
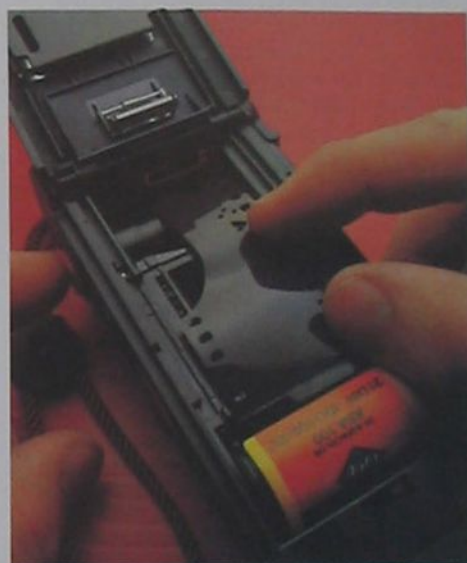
Automatic loading *is a feature of the two Canon Snappies (20 and 50) which is favoured by less technical users*

not, however, notice graininess and do not identify it as such, simply saying that grainy pictures look a little fuzzy even though they may be completely sharp.

Furthermore, while photographers will study prints carefully, and will even examine them with a magnifier, most people looking at holiday snaps simply hold them at a comfortable viewing distance, from which graininess is hard to see. They are far more influenced by colour casts or poor exposure than by graininess. Both the 110 and the Disc films had noticeable casts compared with the 35 mm films. The Polaroid prints all had a strong blue cast. While the results might be acceptable with no others for comparison, they were clearly inferior to even the Disc pictures as far as colour is concerned, though they were quite sharp.

The outdoor vignetting test gave varied results. Almost all but the Olympus Trip and the Nikon gave strong vignetting, the Balda being slightly worse than the rest. The indoor flash

2569

Instant and non-instant prints

An instant print *is a distinct advantage in many types of photography. You know immediately what the results are like, and can give a print to someone whom you have photographed, such as friends met on holiday for instance. But this Polaroid print (taken by the AF 660) has dull unsaturated colours and a blue cast*

An unmagnified print *taken with a Kodak Brownie appears sharper and much richer in colour than the Polaroid. This simple*

Brownie gives grain-free shots (even compared with 35 mm cameras) because it uses the much larger 127 film

Comparison of infinity focus

Nikon FM *with 50 mm lens (fully controlled)*

Agfa Optima *(auto exposure, manual focus)*

Chinon Bellami *(auto exposure, manual focus)*
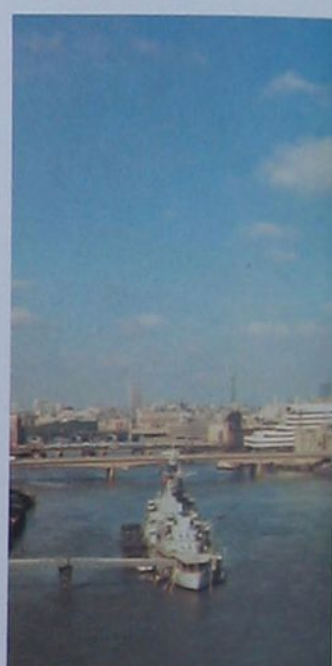
Canon Snappy 50 *(fully automatic)*

results, with the room otherwise in darkness were even more striking. The Agfa Optima gave the best results and the Balda the worst.

Which is best?

There is no perfect camera, just as there is no perfect car. But the test allowed us to draw conclusions as to the suitability of different cameras for different purposes.

A photographer used to good results would be unhappy with the Disc, Minolta, Brownie or Polaroid cameras on account of noticeable deficiencies such as graininess, distortion or colour casts. But each of these have their value—the Disc is ideal for parties, as it is easy to carry and use, and requires no attention, while the Polaroid has the advantage of giving instant results.

The simpler cameras such as the

Snappies are also easy to use, and give adequate print quality for most people. But the keen photographer, and anyone wanting good results from their holiday pictures, would need one of the focusing cameras such as the Olympus Trip or Agfa Optima, which both gave good results. Autofocus is useful for certain subjects, but can be fooled, so is probably best avoided unless you need its advantages.

Comparison of formats

The effect of format on print quality is illustrated in these prints from negatives taken on a 35 mm (above), 110 (above right) and Kodak Disc camera (right). On close examination, each of the three prints appear as sharp as possible for the type of camera, and the difference in quality is due to graininess. In fact, a major drawback of 110 cameras is the small negative, which is only a quarter the area of a 35 mm negative. Even more extreme, the format of the Kodak disc camera is only half the size of a 110, so even the amount of graininess in the Kodak prints is a remarkable achievement, made possible by several technological breakthroughs by Kodak. Foremost of these is the process for making the aspheric lens, the design of which is crucial for such a compact camera. Already, other manufacturers have developed disc cameras, but without an aspheric lens system, it will be virtually impossible to match Kodak's quality on similar sized cameras. Equally important for print quality is the standard of processing would be noticeable on a disc

Fixed focus range

Fixed focus cameras give their best focus when the image lies within a range of about 3 to 10 m, as is evident on this shot by a Canon Snappy 20

Vignetting with and without flash

Vignetting without flash in daylight: Olympus Trip (below); Balda (bottom)

Vignetting with flash in darkness: Agfa Optima (below); Balda (bottom)
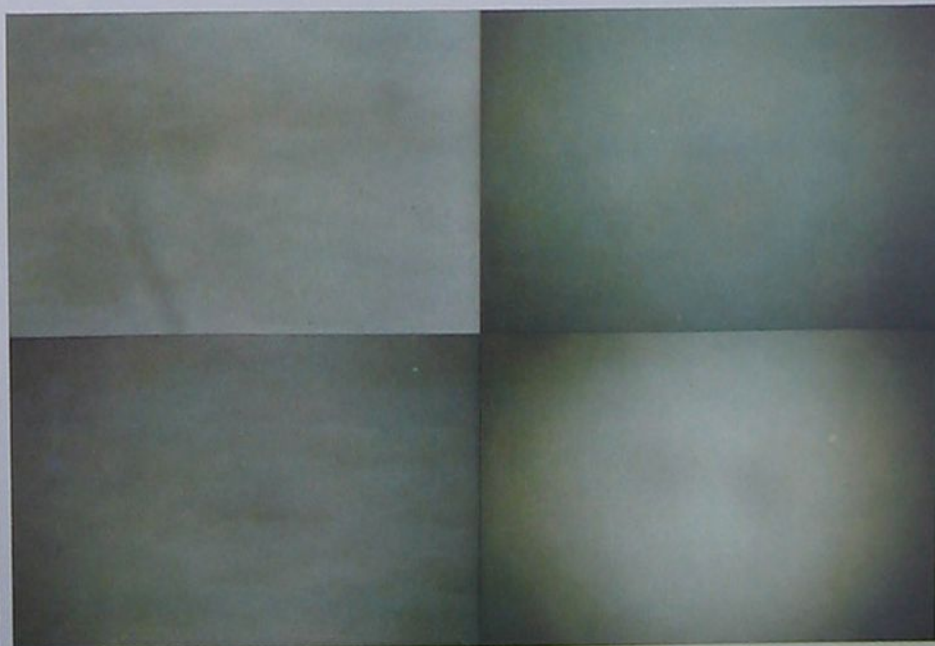
Angelo Lomeo

they could be photographing an oil refinery in Newfoundland for a company report, while the next week they could be exploring the potential of an abandoned farmhouse for a personal project.

The paths that led each of them into their profession were quite different. Angelo began his career as a commercial artist in the USA but became more interested in photography and eventually took it up professionally. Sonja was born in Czechoslovakia and developed an early love of photography after being given a camera at the age of 14. She assisted Josef Sudek, the renowned Czech photographer, for a year which taught her 'what good photography is all about' and later emigrated to the United States. They are both keen to point out that they received no formal training. Sonja explained, 'We are both very happily self-taught, which I think is a very fortunate occurrence. Having no study background and nobody trying to exert a strong influence, you have to grope your way towards your own personal vision.'

Most of their early commercial work consisted of photographing works of art for museums. They both found this a stimulating area—not only did it mean gaining a solid grounding in technique from using 10 × 8 and 14 × 11 in view cameras, but they also learned a lot about colour and composition from working with some of the world's greatest paintings.

Like Sonja, Angelo feels that nowadays many people undervalue the necessity of learning technique and that there is too much of 'anything goes'. Thorough familiarity with light, film and equipment is essential, as Angelo explained. 'When I take a photograph there is something in the viewfinder that turns me on. When the slides come back from processing it's a great feeling to see that element still there.' Sonja added, 'With so much competition in photography many people have resorted to something outrageous or gimmicky. We long ago decided that this was not for us. There is so much wonder and excitement in real life, that I am almost allergic to manipulation.'

World of photography

Sonja Bullaty and Angelo Lomeo

Working individually and as a team, Angelo Lomeo and Sonja Bullaty have achieved a considerable reputation both for their commercial assignments and their many personal projects

A shared passion for photography brought Sonja Bullaty and Angelo Lomeo together as a husband and wife team over 30 years ago. Since that time they have become established as two of the top New York magazine and book photographers. An initial commitment to take on only the type of work that genuinely appealed to them and to 'specialize in not specializing' has meant that their love of photography persists and their work is still as diverse as ever. One week

John Heseltine

Angelo Lomeo and Sonja Bullaty at home sitting under two of their own images

Motel porch By exposing mainly for the lit areas of the building Bullaty has created an atmospheric picture

Angelo Lomeo

Although they mainly work as a team, there is an obvious distinction between their joint work and their individual quests for images. On commissioned assignments they send all their material to the client marked 'Bullaty/Lomeo' so it is never clear who took a particular shot. They also research, plan and shoot un-commissioned shots together and these are also credited jointly.

Usually they are hired for their personal vision, so a tight brief is superfluous. Clients are satisfied to allow them a relatively free hand to make their own interpretation of a place and Sonja and Angelo are happy not to have restrictions imposed on their style. Commissioned work also has the added bonus of allowing them to spend some of their own time shooting stock material. Always insisting on having copyright returned to them, they have fought many

Weatherboarding *Careful framing has eliminated the non-essential detail. Taken for Lomeo's 'Once upon a time' project*

battles to uphold a photographer's right to retain the rights to his or her own work.

Indeed a majority of their work is the product of personal projects which are photographed with a view to selling them later on. Increasingly, they tend to go off without having a client to answer to and shoot just what they want, wherever they go. Much of their travelling is done together, but once at a location they work separately, on their 'solitary searches for images'. Even working in the same area as one another, using the same equipment, they always come away with completely different images. Angelo spoke of their travels, 'Sometimes I will see something and say Sonja, that's a shot for you. And sometimes it will work the other way— we have such separate, independent visions that we never seem to conflict.'

From photographing works of art, their subject matter broadened out—often taking them into the North American countryside where they started to make a reputation for their fine black and white photographs of trees and the landscape. Gradually, they started working with 35 mm Kodachrome and got work with magazines who were prepared to send them abroad to photograph extensive colour features. Stories like 'June in England' or 'Kafka's Prague', which was

Autumn in Central Park *A speeding yellow taxi framed between the changing colours of the trees transforms the image*

Abandoned farmhouse *The poppy-strewn grass in the foreground adds to the sense of atmosphere and quiet beauty*

Sonja Bullaty

Angelo Lomeo

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these are the product of careful observations, not clever image manipulation. She explained, 'Photography is the most powerful art form of the twentieth century. Its beauty and strength is its ability to capture life.'

Their work has now taken them to locations all around the world but, when they are not on personal or commissioned assignments, Sonja and Angelo divide their time between their farmhouse in Vermont and their apartment in Manhattan overlooking Central Park. However even at their homes there is plenty to do. For a couple who live 'in awe of nature,' Vermont offers unlimited subject matter, but they have also risen to the challenge of photographing New York City, its beauty, violence and craziness.

They keep most of their personal transparencies themselves—these are often the ones least likely to sell anyway—but the bulk of their stock material is handled by The Image Bank. Print sales have also become an important source of income to them and prints of their photographs, sold by several New York galleries, can be found hanging in many private homes and corporate offices.

Another outlet for their untiring energies is teaching. They give annual courses at the Maine Photographic Workshop and New York's International Centre for Photography. In their teaching they find two methods particularly helpful. One is to assign their students to photograph in a very restricted area—like the corner of a field or a city block. Another favoured method is to restrict them to one camera and one lens. Sonja explained 'Simplifying is terribly important in photography—basic equipment, simplified compositions and careful use of colour. This comes as quite a shock to some of the avid students who turn up with $10,000 worth of camera equipment, but I think that, in the end, they appreciate the discipline.'

Sonja and Angelo themselves keep their own equipment down to a minimum—one Nikon body each and sharing 28 and 55 mm macro lenses and 80–200 mm zoom between them. Occasionally they use extremes—an 18 mm or 400 mm—but generally they prefer to carry only as much as can be comfortably loaded into a backpack.

But equipment is not a subject that either of them care to discuss at length. What is most important to them is to carry on shooting and to continue to work hard at the profession they love so much. Sonja concluded, 'We want to show people the world the way we see it. To stimulate someone else's vision is the greatest reward we can ever receive.'

Dusk on Park Avenue *Conceived by both photographers to make use of the strong contrast of red lights and cool blue dusk*

commissioned by *Horizon* magazine, allowed them to apply their creative talents and inventiveness to subjects that could be given in-depth coverage in the magazine. 'These early assignments used to be very interesting and it was well worth doing them, but nowadays they can usually only give you two pages of a magazine so it becomes a bore.' While they do magazine work and company reports their more recent work has been mainly for books—they feel that these are 'somehow more permanent.' The Time–Life *Wilderness* series kept them very busy while they have also been heavily featured in books like *Manhattan* and *American Anthem*.

Not specializing means that there are many threads in their work and hundreds of areas which they have covered. Often they are associated with their landscape work, but this is only a small part of their overall output, just as the photographs shown here only represent a small fraction of their interests. One of several personal projects that has occupied Angelo recently is a series called 'Once upon a time' that deals with old buildings, abandoned cars, faded colour—in fact anything which evokes a feel for a bygone era, traces of yesterday's man now being reclaimed by nature.

Like Angelo, Sonja's work covers landscape, cityscapes, wildlife and what they both call 'peoplescapes'. She also does her own personal projects, one of which is on symbols of American life, its humour, its vastness and sadness. Her photographs often concentrate on odd moments and unusual juxtapositions, but

Bullaty/Lomeo

Printing chromogenic film

Chromogenic films offer enormous latitude and very smooth grain. They also, however, present new difficulties in the darkroom, which must be overcome if you are to make the most of their special qualities

One of the attractions of black and white chromogenic film like Agfa Vario-XL and Ilford XP1 is their incredible wide exposure latitude when compared to conventional black and white film.

The latitude is such that a single film can be exposed at ratings varying from 100 to 1600 ASA and, given standard development, yield printable negatives from every frame. At high ratings chromogenic films give smoother grain than uprated conventional high speed films and as general purpose films they are unbeatable, with even quite considerable under or over exposure making relatively little difference to the final result.

Chromogenic film offers such great flexibility because it combines many of the characteristics of a high speed and slow speed emulsion in one. The halide grains are generally very much smaller than those of a conventional fast film such as Tri-X or HP5, and there are more of these grains.

The theory is that what it loses in terms of large grains, for increased sensitivity, it gains in terms of the number which are rendered developable—as the latent image—and which are partially reduced during development.

Both Vario XL and XP1 can be processed either in the manufacturer's own recommended chemicals or in standard C41 colour developers. The difference in results is fairly marginal and can only be seen in large prints under close inspection. As a rule, C41 gives slightly smoother grain but loses out in edge sharpness, making large prints appear slightly less crisp.

To test the difference, shoot off two lengths of XP1 using the same subject and exposure settings. Have one processed in C41, the other in the XP1 chemicals. As personal standards of quality vary so much, make your own assessment simply by printing negatives from each strip. Enlargements should be of the usual size, and made following your usual routines. Decide on the strength of the results whether or not it is worth the extra effort to channel the XP1 you shoot through the film's own process solutions.

Exposure tests

A characteristic of chromogenic film is that shadow detail is recorded as if on low contrast material and yet the highlights are usually contrasty by comparison.

An interesting series of tests would be to check out the printing quality of chromogenic negatives that were exposed and processed in different ways. Try comparing, for example, lengths of XP1 which have been developed normally with others over-developed according to guidelines once suplied with the basic kit. In each instance, expose negatives at half or whole stops either side of 'normal' exposure. A typical sequence will show the effective working latitude of the material, whether or not extra develop-

Trees *The variety of tones produced by chromogenic films compares well with conventional materials*

ment was given (see assessment panel).

In normal use it is probably best to stick to one development time and rely on the extremely wide exposure latitude of chromogenic film unless a special characteristic—perhaps discovered during testing—is particularly required. Downrating chromogenic film to, say,

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Pushing and pulling

Overexposure *by four stops gives greater shadow detail*

Normal exposure *shows good detail in shadow and highlight areas*

Underexposure *by two stops gives higher image contrast*

Ilford XP-1 processed in C41

Overexposure *of the negative by four stops gives a loss of highlight detail*

Normal exposure *shows better blacks and whites than with the Agfa*

Underexposure *by two stops shows less tolerance than with the Agfa*

Ilford XP-1 processed in XP-1

Overexposure *of the negative by four stops—one second at f/16*

Normal exposure *here gives the highest contrast of the three tests*
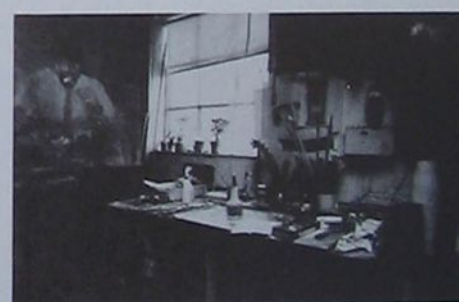
Underexposure *by one stop showing even less tolerance than with C41*

100 ASA in effect overexposes it by two stops, if normal development is given. Although this speed gives smoother grain than a 400 ASA exposure, sharpness may not be quite so good—a paradox explained only by the peculiar dye image forming characteristics of chromogenic film.

But if you do downrate, bear in mind the effects on the highlight parts of the image which may then require burning in if they are to show detail.

If you underexpose the film by uprating it without increasing development, graininess will increase because fewer silver halide grains are used in the formation of the image.

XP1 home processing

Processing at home is not difficult but requires care (see pages 394 to 397) whether you are using C41 or XP1 processes. The concentration and pH of solutions, and storage of film and

Bob Cross

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Ed Buziak

Trees *Subjects such as this, with normal to low contrast, can be printed straight without any need for dodging or burning-in*

chemicals are no less important than in colour work and all influence the quality of results and thus the ease with which you can make the resulting prints.

Ilford XP1 bleach–fix chemicals have been modified for better results and they recommend that the two chemicals should not be combined to make the stock blix solution until you are ready to use it. Ilford, in any case, recommend using their liquid concentrate XP1 process solutions in the 'one shot' mode and it is usually more convenient to dilute these shortly before use.

Store any unused chemicals in glass and not plastic bottles, or make use of Ilford's own XP1 solution containers. These are made from polypropylene which does not allow oxidation to the same extent as common formula polyethylene containers—so keep these for possible future use. Always expel as much air as possible before screwing on the cap—and use as small a container as possible. But observe the conditions and lengths of storage claimed by Ilford for each type of chemical.

If XP1 processing is required, but you cannot do the job yourself, you could send your film to an Ilford accredited XP1 process house who can also provide correctly exposed contact proofs show-ing all printable frames on a roll of film. Because of the film's wide exposure latitude, a straight contact print cannot usually be made without frame by frame dodging unless special printing equipment is used—as by these specialist processing houses.

C41 processing

If you are lucky enough to be equipped for C41 processing there is temptation to put all types of film, through the same baths and extend development times or add replenishers. After all, Vario-XL is processed in C41—and XP1 can be—and so can any compatible colour negative material.

But while there is no evidence· to suggest chromogenic film has any effect on colour film processed along with it in the large volume baths of a commercial processing line, problems may arise in the low-volume confines of an amateur set-up. Not all films behave in the same way and some release more by-products than others in the all encompassing C41 process. While the presence and effects of these by-products are nullified by regular replenishment in commercial set-ups, this is beyond the capabilities of a typical enthusiast.

Ilford's own tests suggest that no problems are likely to arise if both colour and black and white films are processed in the same solutions, but if you want to be on the safe side use different chemicals for each type of film.

Assessing negatives

When dry, chromogenic negatives appear to have rather low contrast, like a colour negative, with a brown-to-magenta image on a pinkish purple base. Agfa have modified Vario-XL film to look similar to XP1—it used to have a bluish appearance. So there is no need for alarm if your chromogenic films all seem different—you may have some of the slightly older stock.

In fact, the visual appearance of these films bears little relevance to their printing nature. Yellow and magenta dyes form the printing density and cyan dyes are added to help make the printing image more easily visible and pleasingly natural.

One of the teething problems with chromogenic films is that sometimes they tend to take on a green cast. Ilford suggest that this may be due to formaldehyde or other fumes, but you can minimize the risk by careful storage of the film at all times. In any case, unless extreme this effect is unlikely to have a serious effect on the appearance of prints.

Extended development produces more magenta dye than yellow and this may result in a slight colour change also. But this only makes the printing time longer—little else changes.

Accurately assessing negatives is one of two main problems experienced in printing chromogenic negatives. A conventional negative image is made up of metallic silver whose printing characteristics are proportional to the density of these deposits. But a chromogenic image consists of magenta and yellow dyes whose reddish colour tends to act rather like a safelight to blue-sensitive black and white printing paper.

As a result it can be very difficult, especially at first, to judge the contrast of chromogenic negatives and the exposure they are likey to need. Generally speaking, chromogenic negatives tend to appear flatter than they really are so that, for example, a negative which looks as though it will need grade 4 paper will in fact print properly on grade 2. So if you find yourself constantly needing to burn in highlights or hold back shadow areas it is likely that you are simply consistently underestimating the contrast of your negatives.

A properly exposed contact sneet can be a great help at this stage as it allows direct frame by frame comparison of image contrast and negative density. Write all relevant information on the contacts.

Extended overdevelopment is not recommended by the manufacturers as it causes the overall fog level to rise and is in any case usually unnecessary—the latitude of the film is such that normal development of films rated at 1600 ASA will yield printable negatives.

Ironically one of chromogenic film's great strengths is also, for some purposes, its greatest weakness. While highly pleasing for some subjects, the
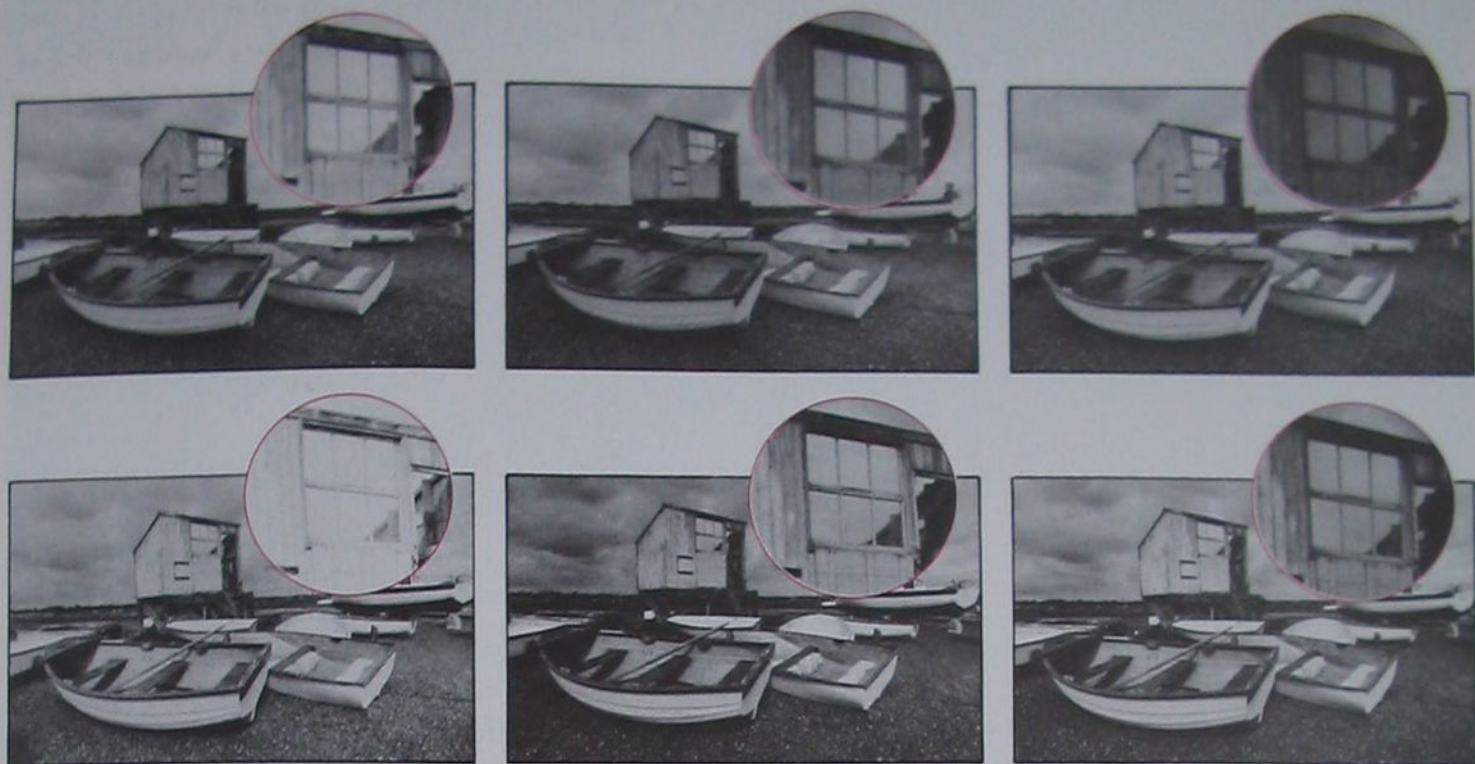
lack of grain can mean that prints of a deliberately harsh nature lose much of their 'punch'. In addition, the smoothness of tone can cause difficulties with retouching—whereas stippled retouching is invisible against the grain structure of conventional materials, it tends to show up clearly in the areas of smooth tone characteristic of chromogenic film.

Printing
Although the Callier effect—the scattering of light by the grains of a conventional silver image (see page 2185)—is almost entirely eliminated on account of the dye image, using a condenser enlarger gives slightly crisper results than those obtained by using a diffuser enlarger. But there is no appreciable difference in the print paper grade that is required—with a silver image, a diffuser enlarger produces a softer contrast image than obtained with a condenser enlarger.

On the paper side, variable contrast papers such as Ilford Multigrade or Kodak Polycontrast permit the elaborate contrast grades dodging which may be needed for really 'difficult' chromogenic negatives. You could use one grade filter for the shadow and mid tones and another for highlights (see pages 424 to 428).

When printing on to variable contrast papers from chromogenic film you may possibly find the long exposures give a softer result and require a higher contrast filter than if you were printing from a conventional silver negative, but with experience you will learn to make allowances for this.

Comparing the chromogenics
Of the two films, Vario-XL seems to offer slightly the greater range of printable negatives if a straightforward comparison is made of shots taken for a latitude test. Results are, however, of significantly lower contrast than with XP1 and this sharpness-enhancing characteristic may be preferred by some—results seem much 'brighter' with the XP1 film.

Both films respond well to overexposure—but avoid overdevelopment as this will result in unprintable dye densities. Neither film likes underexposure—especially XP1 developed in its own chemicals—so always err on the side of overexposure if in doubt.

Boats *For the test shots above the Agfa Vario-XL and the Ilford XP1 were both developed in C41 chemicals. For the centre shots of each the films were rated at 400 ASA, while on the left they were down rated to 125 ASA, and on the right uprated to 1600 ASA. The Agfa is shown at the top and the Ilford at the bottom. The Ilford gives better contrast overall, while the Agfa seems to be much softer. Although it seems best to rate both films at 400 ASA, a stop either way still gives acceptable results. In the shot below highlight detail present in the negative has been lost at the printing stage. In subjects such as this highlights can be burnt in*
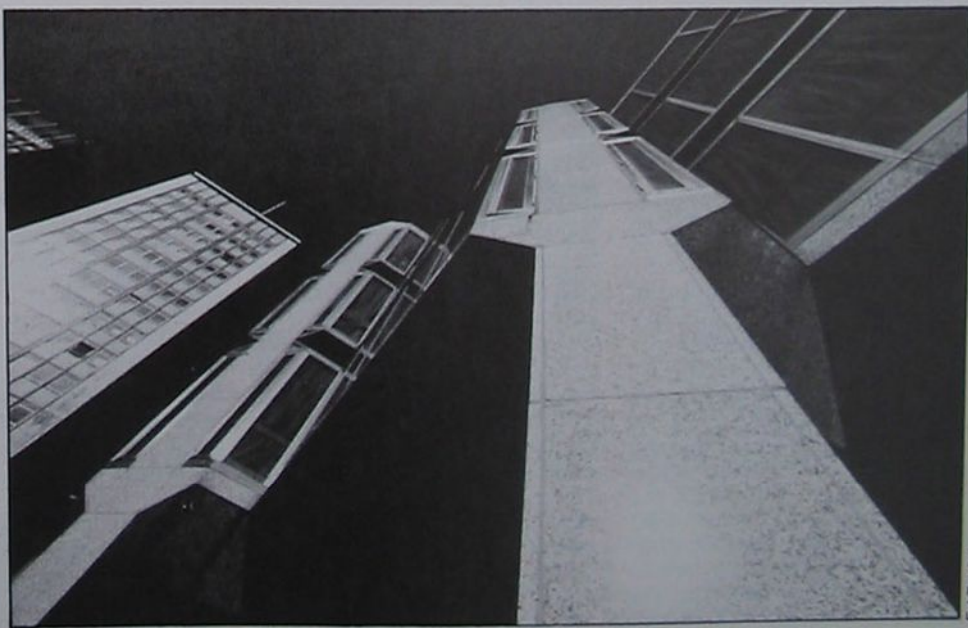
The way the sun moves

Predicting when a particular feature will be in sunlight or in shadow can be complex. But if you understand how the sun's path changes throughout the year, you can often work out when will be the best time for photography

John de Visser

Everyone learns that the sun rises in the east and sets in the west, and as a photographer you may at some time try to make use of this information when planning a picture—to return to a building when the sun shines obliquely on a certain wall, picking out the details, or when a shaft of sunlight illuminates some interior feature. Unfortunately, the sun's motion is far more involved than many people believe, so predicting angles of illumination can be tricky. For example, it only rises due east and sets due west on two days in the year.

Furthermore, the situation is different depending on where you happen to be on the globe, so what you expect from experience at home may not hold true when you are on holiday. For simplicity, what follows applies only to the northern hemisphere; if you live in the southern hemisphere, simply reverse north and south—east and west remain the same.

In summer, the sun clearly moves higher in the sky than in winter, unless you happen to live near the equator. Not only does it move higher, it rises and sets farther to the north. Indeed, the farther north you go the closer to the north point the sun rises and sets until in polar regions at midsummer it never sets at all. During summer, therefore, north facing walls receive sunlight for a considerable period in the morning and evening and, except at the pole itself, the sun shines more of the time on north facing walls than south facing ones. In the tropics north of the equator, the summer sun never shines on the south side of the wall at all, and moves directly overhead at the tropic itself.

At the equinoxes—about March 21 and September 23, the exact date depending on how close a leap year is—the sun is directly over the equator. Only on these dates does it rise due east and set due west, which it does the world over. And day and night are exactly 12 hours each everywhere—*equinox* means 'equal nights'. At the equinox, the sun rises to a maximum height in the sky given by 90° minus your latitude.

At midwinter, the sun rises well to the south of east and climbs much lower in the sky than in summer. Likewise it sets to the south of west, and makes only a short arc across the sky, particularly as you go north.

This has a considerable effect on angles of illumination. Apart from the fact that the angles of illumination will always be lower in winter, if you want to photograph the side of a building which runs east-west with oblique illumination, it will be impossible during winter

Shadows *The sun will fall on this wall from the same direction at the same time each day, but from a different angle above the horizon*

since, even when the sun rises, it is already shining quite squarely on the wall. And if you want a shaft of sunlight to fall on an interior which faces east, only the northerly side of the room will ever receive sunlight. You will have to wait for summer if you want to photograph a detail on the wall directly opposite the window in sunlight.

The maximum elevation of the sun is when it is due south at noon—remembering to allow for local time systems such as Summer Time, which makes noon an hour late. In midwinter, the sun's noon elevation is 23½° lower than at the equinox—and at midsummer, it is 23½° higher.

It is possible to calculate the sun's actual position in the

sky for any date, but calculations are complex and best suited to a mini-computer. Even so, there is a simple way of estimating roughly where the sun will be at a particular time, making use of your knowledge of the way the sun's maximum elevation changes throughout the year. This involves making a simple sundial. The sun is always in roughly the same direction, though at a different height above the horizon, at the same time each day. So if you orient a sundial to the sun, knowing the time, you can immediately see where it will be at any other time of day, particularly if you know roughly how high it will be at noon. Note, however, that the sun does not actually keep regular time—it can be up to 16 minutes fast or slow against an accurate clock because of the Earth's elliptical orbit. The correction, called the *equation of time*, can be found in almanacs.

There is a further correction to be made, which depends on how far east or west you are of the line for which your time zone is designed. For example, if it is noon at Greenwich, England, the sun is still 45 minutes from noon in the far west of the time zone, in the west of Ireland. Noon is four minutes later for each degree of longitude you are west of the time line.

Your sundial should have a

Dennis di Cicco/Sky & Telescope

Sun's motion *The sun was shot on the same frame at the same time every few days, with whole morning trails for 3 days in summer, autumn and winter*

24 hour face, numbered the same way as a clock face (but the reverse in the southern hemisphere). Cut it from a rectangular sheet of card so that noon is along one of the shorter sides, and only cut away a semicircle of clock, from 6 am to 6 pm, so that the other short side is parallel to the 6 am–6 pm line.

Also cut a triangle of card

to support the dial at the correct angle. This angle is 90° minus your latitude—the same as the angle of the sun at the equinox. You can stick this support to the card using a flap which allows you to fold the dial flat. Mark the centre of the dial with a hole.

To use the device, set it up on a level surface, and find out the time, allowing for Summer Time and zone corrections. Hold a pen or pencil next to this time on the dial, and turn the dial till its shadow falls across the central hole. In winter this

will mean looking on the underside of the card. Adjust the length of the pen projecting over the edge until the tip of the shadow just touches the centre.

Now the line from the centre of the dial to the tip of the pen indicates the sun's position, for any time during that day, as long as you keep the pen projecting the same height above the card and at right angles to it. You could even use it to find the time of sunrise or sunset by seeing when the projected line meets the horizon.

Making a sundial to predict the sun's position

Steve Mansfield

1 *Cut and number a disc as shown, and set it up on a level surface at the correct angle, 90° minus your latitude*

2 *Hold the pen at the right time along the edge, allowing for time corrections, so that its shadow falls on the face of the dial*
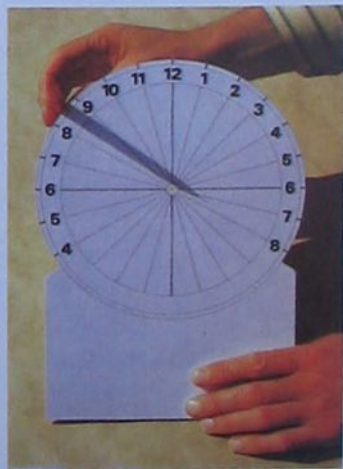
3 *Orient the dial and move the pen up and down so that the tip of its shadow falls on the dial's centre, on one side or the other*
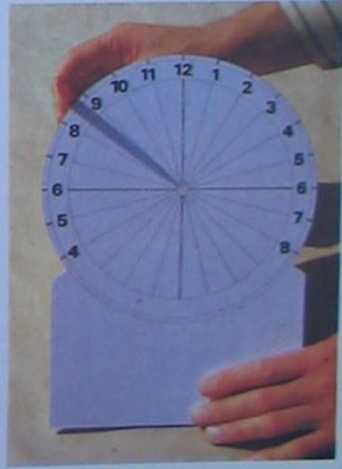
4 *Now move the pen to any time. The line from the dial centre to the tip indicates the sun's position at that time*
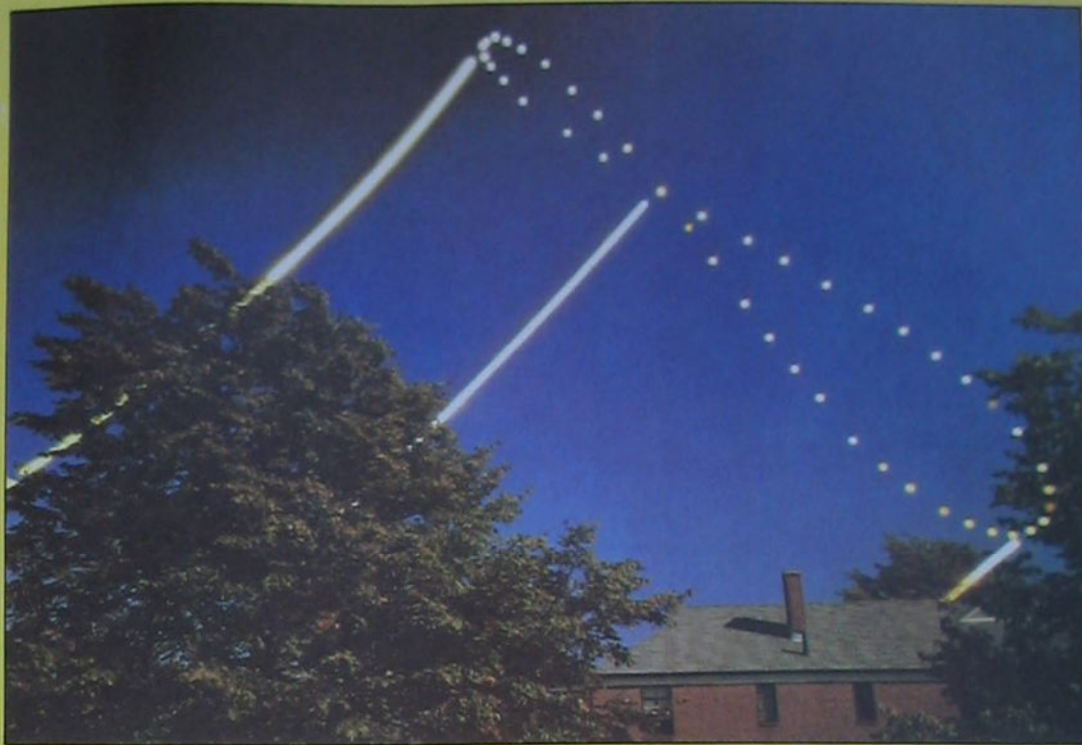
Thinking in B & W
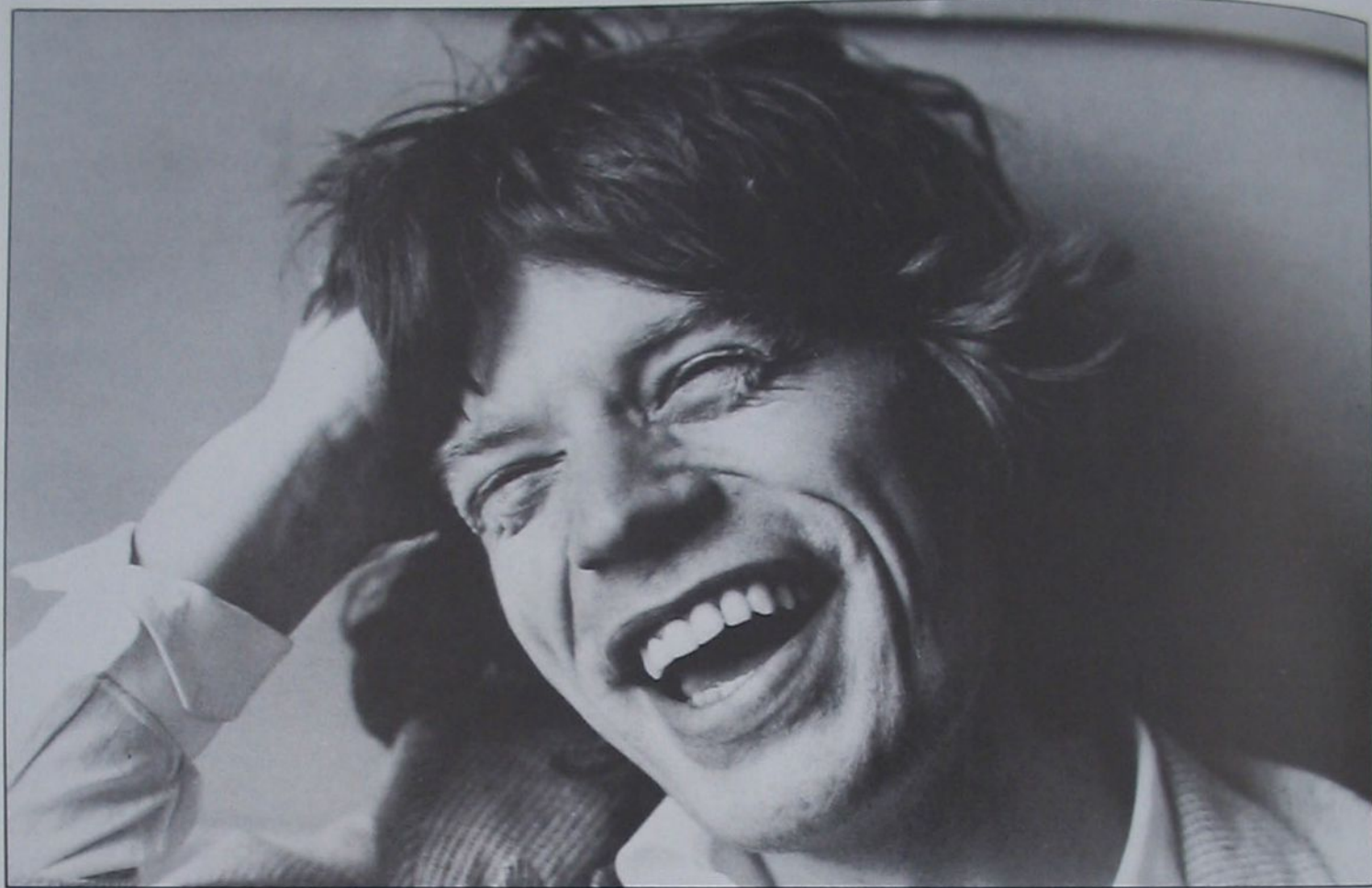
For many pictures, black and white can be far more effective than colour. Yet to make the most of its special qualities you have to learn to see the world in a different way—to think in black and white

To photograph in colour and colour alone seems second nature to many photographers. With slides and a projector or high quality prints that are easily made at home or by a commercial darkroom, the realism of colour has been a forceful addition to a photographer's repertoire. The immediate attractiveness of colour was always in its favour. And now that many of its technical limitation have been lifted, colour seems to have relegated black and white to the back seat of photography.

Yet far from being a poor relation to colour, b & w photography has long been the backbone of the medium. It is through b & w that many photographers have come to learn their craft. Indeed, for many types of photograph, b & w may be far better than colour. Many of the world's greatest photographers are so convinced of the merits of monochrome that they use it virtually all the time. Although Cartier-Bresson does shoot in colour very coccasionally, nearly all his best photographs are in b & w.

There are many different views on what makes b & w so much better for some types of photograph, but most photographers emphasize the way b & w simplifies the world, reducing it to tones of grey. Colour, which can so often be a distraction, is removed and the photographic image is allowed to speak for itself. B & w can have a directness and clarity rarely achieved in colour work.

Yet to get the best out b & w—if you are used to working in colour—you must learn to 'see' photographically in a new way. Subjects that seem to work well in colour may fail completely in b & w. Clearly, subjects that rely totally on colour for their impact are unsuitable for a b & w shot. But it is a little more subtle than that.

There is a great temptation to photograph a scene simply because it looks attractive; a pretty cottage or a sunlit rural landscape seem to make obvious photographic subjects. In colour, this approach often works because the photograph successfully evokes the

Robert Doisneau/Rapho

Abbas/Magnum

Mick Jagger *The simplicity of b & w allows you to capture the essence of a personality in one gesture or expressive emotion without distractions.*
South Africa *The directness of b & w gives political images, like this hieararchy of privilege, impact often lacking in colour.*
Pin-ups *A good b & w print has a richness of tone which can create an almost super-real look to textures— fabrics, skin, cold metal.*
Skinheads *Thinking in b & w means, above all, going beyond the technical aim of accurate record and using its clarity to concentrate an essence image— here menace*

John Freeman

original scene. A b & w photo cannot always do this as well because, with colour removed it is one step further from reality.

This abstraction is not necessarily a disadvantage for creative work; it simply means you must choose your subjects more carefully. Indeed, it may be an advantage because it can often shift the emphasis away from the original and towards the picture itself. If you have a message in your pictures, therefore, it may come across with far more clarity in b & w than in colour. This is one of the reasons why b & w is still so popular with photojournalists—particularly those using pictures to make political comment.

Taking the idea of a message a little further, b & w can often give far more expressive portraits than colour. In colour, people are often diverted from the clues to character by the colours in the skin—the variation in hues on various parts of the face, the minor blemishes and so on. In b & w, the viewer's attention is focused on the person's expression, the way he holds his head and other indication of personality. Personal attractiveness may become less important than character.

In other types of photograph as well, where the photographer has something to say, b & w may be a stronger medium. Some photographers, for instance, use black and white symbolically, using them to put across an idea not stated directly in the picture but by association.

Robert Frank, famous for his book *The Americans*, cited black and white as the true colours of photography. To him the symbolic nature of these two tonal extremes were perfect. Light and dark/good and bad, or as he expressed it 'hope and despair'. Thinking of ways in which a subject may suggest something

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else, is a good starting point for exploring the creative potential of monochrome. If colour can show, quite faithfully, how something looks, with black and white suggestions can be made about what it means to the photographer. This need not be just ideas of 'good and bad', these are simply extremes of feeling. Think of how a generally high key picture is not only light in tone, it is usually light in mood as well. In a low key picture, on the other hand, the mood is generally much heavier.

Yet there are other sides to b & w apart from message. Although b & w is more abstract than colour, it can often give an image more 'real' than any in colour. This may seem like a contradiction but monochrome achieves this realism by throwing the emphasis on to the shape and texture, since there is no colour to distract. While colour is a visual quality entirely, shape and texture have a very strong element of feel. With strongly shaped or textured subjects, therefore, b & w can have a tangible, almost super-real look, particularly if the lighting is calculated to bring out these qualities. Edward Weston's famous shot of a pepper shows just how dramatic this can be (see page 2002).

On a more mundane level, you could

Graham Smith

Boy with toy hand grenade *In b & w the eye is held by the essentials—here the boy's posture and facial expression—and not led away by irrelevant colours*

Man *Remove the distraction of colour and proportion can become a more powerful tool—the tiny individual is dwarfed by his environment*

use b & w when colour will detract from your intended purpose. Often, by using black and white, you can express what you have seen more directly. Imagine a tree seen against the skyline, bent by the wind into the form of a giant human figure. In colour, while the form still exists it can be confused by a myriad of tints. In b & w, the shape you saw is clearly revealed. By employing its graphic strength you can make strong compositions that sum up a situation concisely while retaining its impact. B & w can reduce an image to its essentials and communicate with speed.

Imagine that you have two cameras with you—one loaded with colour and one with b & w. What factors should you consider in deciding which camera to use for which subject?

One way to answer this question is to pose another 'Will my intentions in taking this photograph be helped or hindered by the inclusion of colour?' The answer to this question will depend on your intentions. For example, if you want to photograph a rose you are likely to be trying to capture as much of its natural beauty as you can, a beauty which relies largely on the colour. For any but the most skilled, a b & w shot of a rose is likely to appear dull and lifeless. If, on

Fay Godwin's

two or more of these elements, which you should emphasize? The answers to these questions should guide your technique at every stage from the initial exposure to the final printing. The ability to visualize the final print in your mind can only be improved by practice.

Almost any subject can make a good black and white photograph—even a rose—but some are more obviously appropriate than others. Strong patterns, railway lines, buildings with powerful graphic elements and receding lines of trees or telegraph poles invariably produce striking images.

For colour work, it is likely that the only major consideration in deciding what film to use is the speed you think you are likely to need. In addition, once the photograph is taken there is practically nothing that can be done during the processing stage to affect the image. Except on rare occasions, even colour printing has only one real objective—accuracy. In complete contrast, the choice of black and white materials and the way they are treated in the darkroom will play a major part in the appearance of the final print. What you do with the film when you have removed it from the camera can be as important as what you do when it is loaded. Various factors are affected by your choice of

Sea *Your treatment of shapes and tones should express the subject's qualities. Thus gentle shapes and flowing tones echo the harmony of land, sea and sky*

Bathers *To exploit the possibilities of b & w, you must pre-visualize a garish colourful scene as a source of smoothly restrained grey tones and shapes*

the other hand, you are taking a bleak photograph of an urban landscape, the colour is likely to be at best an irrelevance and at worst a distraction.

As you gain in experience it will become easier to think in black and white. This means that rather than asking whether a given photograph will be helped or hindered by the inclusion of colour, you start to look specifically for situations which have black and white potential. The b & w photographer must learn to look at the world not as a collection of 'things' to be photographed, but as a collection of shapes, textures, patterns and forms.

As accuracy may be less important than aesthetic interpretation, it is no longer enough to automatically use the exposure given by the meter. Instead it is necessary to decide, when the photo is taken, what kind of treatment this subject should be given. Will the print work better in low key—a collection of dark grey tones which gives a brooding, melancholy result? Or would high key be more appropriate with a predominantly white print, with details being picked out in black? Which feature of the print will be of greatest important? Is it the texture, the form, the shapes or (as will usually be the case) some combination of

André Gelpke

James Ravilious

materials and processing, among them the element of grain.

On many occasions you may have little choice about the graininess of a photograph: coarse grain is a built-in feature of fast films and you may need the speed because the light is poor or because there is rapid movement. Often, however, it is possible to choose the graininess to suit the image and your own preferences. A fine-grained film interferes very little with the form of any image, but noticeable graininess makes the presence of the photographic process more obvious aesthetically, in the same way that brush strokes in a painting may reinforce the image. For example, using a fast, grainy film to photograph dark stormclouds can give them greater weight and presence in the picture, whereas with a normal sky, a fine-grained film can preserve the delicacy of light clouds. The texture of graininess is most apparent in large, evenly toned areas that are intermediate shades.

Another technically based quality of black and white photography that can be controlled in a way that is rarely possible with colour is contrast. Essentially, contrast in a picture is a measure of the spread of tones, from light to dark. Although with colour film there is little scope for altering the range of tones significantly, short of abandoning realism, contrast control in black and white photography is an integral part of

the process. You should use the contrast in your pictures to reinforce the desired effect, perhaps exaggerating a silhouette by overdeveloping the film and using a hard grade of paper or printing a rural scene in low key for a deliberately understated result. When judging a scene you are about to photograph, quickly run through its contrast possibilities in your mind.

The use of coloured filters adds a further degree of control, allowing you to turn the image towards your own ideas,

Key points
Look at the world as a collection of shapes, patterns, textures and tones

Decide whether an image depends on colour for its effect—will the absence of colour be an advantage?

Compose carefully remembering that all the work of composition has to be done by grey tones and that the eye is drawn to areas of light tone

Use specific films and filters to reinforce the effect you have in mind

Think about how this image will be printed—high key or low key, soft and flat or hard and contrasty?

Practice looking at the world in black and white, ignoring colours

Work on the ability to visualise the final print in your imagination while looking at the subject

Sheep *If in colour, the rich green grass would have dominated and suppressed other elements such as the tree's shape— b & w can often give a better balance*

rather than simply reproducing what you see. To get a dramatic demonstration of the differences this can make, try photographing a landscape with a blue sky without filtration and then with yellow, orange and red filters and compare the final results.

But however much you play around with a b & w in the darkroom or in the field, it is important not to let the technique become the be all and end all. More perhaps even than colour, the original image must be strong—you can never fall back on pretty colours to rescue a basically weak image. The subject itself must be interesting for b & w work—or, at the very least, it must have an interesting shape or texture.

Many people see b & w photography as old-fashioned, the poor cousin. In fact it is a different rather than an inferior medium. Colour photography's great appeal lies in its ability to photograph the world as we see it, but simply recording the world is a rather limited ambition. Beyond this, in the world of creative photography, black and white photography will continued to have a value of its own, no more inferior to colour than charcoal drawings are to oil paintings.

ABSTRACTS

For successful abstracts you must make good use of colour, graphic elements
and what John Sims calls 'the puzzle element'

For a photo to form a successful abstract image it must contain or be made up from simple elements which, when combined, produce a strong visual statement. This statement can be created in a number of ways; by the use of colour, graphic content and by what I term the puzzle element. The first example does not really succeed in any of these ways. To improve the photograph I would stand further away from the door/wall and wait until the evening sun gives a stronger shadow. This would help to separate the door from the wall and at the same time lift the contours of both surfaces significantly. To strengthen the composition I would frame vertically and alter the relation of the two basic elements so that one dominates—as it stands, the photo suffers from an uncomfortable symmetry

In this photo a good abstract situation has not quite been used to the full. The photographer has allowed the subject (the helicopter) and the dominant colour (red) to overwhelm. Using additional elements would have given a more balanced and a more abstract abstract. I would have shot from lower down and more to the left, using the 'H' of the grille to echo the lines of the rotor blades. I would also make the cockpit unrecognizable to provide a stronger puzzle element, and if I had time I would be tempted to wait for a blue sky to give more variety of colour — perhaps using a polarizing filter to strengthen tones

I find this example particularly intriguing because again it appears to fulfill my main conditions for a succesful abstract photograph. The colours are tonally strong and well saturated; the combination of circular shapes against the clean lines of the deep brown and ultramarine background looks good; the puzzle element is clearly present. Unfortunately the picture falls down on three major points. The scratches on the plastic filter holder would, with any substantial degree of enlargement, both desaturate the red and become very distracting. Secondly, the light area in the top lefthand corner is not strong enough for the composition and reduces the impact of the deeper hues in the remainder of the picture. This problem is easily solved by cropping in from the left. Finally, the whole image appears soft

I quite like the cool tonal range of this shot and the contrast between the irregular curved shapes and the metallic blocks in the centre of the frame. However, the more I look at the tarpaulin in the foreground, especially its frayed and out of focus edges, the more dissatisfied I become with the whole image. It is the central area which provides most of the scene's abstract potential. I would have concentrated on the blocks, the textured tarpaulin and the sky, trying wide and macro lenses, perhaps with a polarizing filter. Tight cropping here would have helped achieve the unity of composition which marks the successful abstract

Creative approach

Distortion

Many photographers strive to achieve an accurate record of the world, but the creative photographer should have no such limited aim. You can distort the world deliberately to produce startling images from the most ordinary subjects

The vast majority of photographers aim at nothing more than an accurate and normal looking representation of the world as we expect to see it. Most cameras are used with a lens which gives a result as close as possible to the view seen by the human eye and a film which can be counted on to give accurate results. And yet this approach means denying yourself the opportunity to look at the world in a different way. By the creative use of distortion you can make the world conform to your own ideas—or you can just distort for the fun of it.

Distortion can be used for many different purposes. No list can be exhaustive but among the most obvious uses of distortion are to create abstracts, to produce humorous or puzzling images and to make a comment in a direct and concentrated way.

You do not necessarily need to use special techniques or equipment to find a distorted view of the world. Careful observation will show that there are a number of ways in which the image of an object is distorted naturally. The modern world is full of reflective surfaces, for

Rain *With a long exposure, moving coloured objects and lights become more or less blurred streaks—particularly effective against the blacks of night*

Reflection *Photographing reflections is easy, but to succeed they must, as here, be genuinely interesting—you should try to be selective*

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instance, which reproduce it in more or less distorted form.

When shooting a reflection, you do not always have to frame to include the reflected object. Indeed, the reflected image might complement the object nicely, showing both a normal and a distorted view. Sometimes the nature of the reflecting surface itself might be interesting—you could choose the reflecting surface to suit the subject. It could be a neat way of visually linking two images. You could, for example, photograph a Rolls-Royce in a city street from such an angle that a tall skyscraper is reflected in its gleaming bodywork to link the opulence of the car with the work that produced it. Done carefully this can be a very effective way of juxtaposing two connected images, with one distorted and framed by the other.

If you shoot the reflection alone, it usually needs to be a very strong or brightly coloured image—most reflections are rather muddy and uninteresting when reproduced.

Cars are a good source of reflective surfaces of all different shapes and sizes—paintwork, windows, hub caps, chrome strips, wing mirrors and so on. A polished surface will always give a better result, so look for these possibilities at a vintage car rally, or look for gleaming limousines or sports cars in a city street. Brass instruments are usually kept gleaming by proud bandsmen and are always an excellent source of reflective surfaces. Windows, from the vast and nearly smooth plate glass expanses of modern architecture to the rippled glass of older buildings, are often very suitable for shooting at or through. Buildings often contain brass or chrome fitments which can give good results, while for an even more controlled approach try making your own reflective surfaces out of tinfoil or plastic mirrors.

While photographing reflective surfaces, it is important to remember that you are likely to appear in your own picture, so either use this effect or minimize it by photographing through a hole in a screen with the camera mounted on a tripod.

You can also create many distortion effects by placing semi-transparent objects in front of the lens. This can mean anything from the use of basic filters to using all sorts of unusual materials to distort and refract the light to a greater or lesser degree. Various manufacturers now make a whole variety of special effects filters which can be used singly or in combination. Some of the more interesting include the linear shutter, which gives an elongated and slightly blurred image (see page 1400), and the prism, which surrounds stark objects with coloured fringes. But there is no need to use only the commercially available filters—you are more likely to get individual results if you make use of more unusual methods. Coloured bits of glass, broken bottles, bits of net curtain, out of focus branches—almost anything

Robin Bath

can be used to interfere with the light on its way to the lens.

Try focusing in unexpected ways, perhaps using a stark but dull object such as railings in the foreground, with the subject behind thrown deliberately out of focus, or leaving the whole image out of focus, registering as a completely abstract collection of blurred colours.

In all these largely abstract images there are two basic guidelines to bear in mind. One is that the best results will generally be achieved with strong uncluttered shapes and colour, which can give tremendous impact even if the subject is completely unrecognizable. The other is that you should be courageous with your ideas so that your pictures look self assured and not like mistakes. If you are photographing bright patterns out of focus, make them completely out of focus. If you are deliberately giving a shot a strange colour cast, give it a strong cast. This

makes your intentions clear and prevents people from saying 'what a pity you didn't get it quite right.'

There are also many less extreme uses of distortion which aim at a recognisable image rather than a pattern or graphic design.

Distortion for a humorous effect, or to challenge our normal way of seeing the world can be very simple or exceedingly complicated. At the easiest level, try photographing a friend from close up with a wide angle or even a fisheye lens. The results will look peculiar wherever you shoot from, but if possible try to emphasize a particularly noticeable feature—shoot from below to make the chin dominant or from above to produce bulging eyes over a receding face. At a rather more complex level you can deliberately photograph familiar objects so that their proportions outrage our sense of scale. You can, for example, photograph a friend 'sitting on a
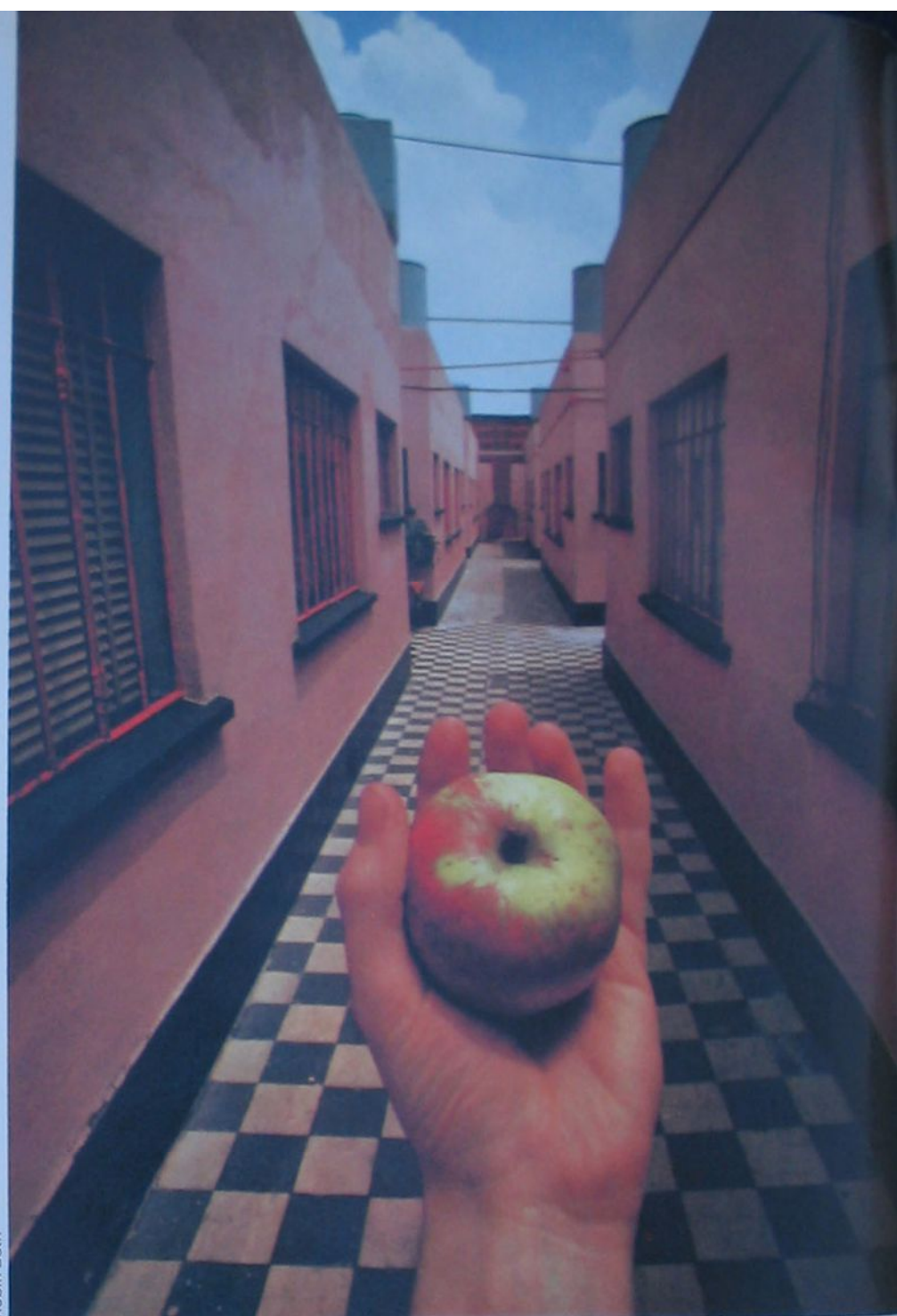
Apple *A surreal image—distortion achieved with a wide angle lens. When taking shots of this kind it is usually precision which is the key to success*

Trinidad *A basic distortion method—zooming during a long exposure—and one which usually works well with bright, colourful and energetic subjects*

Portrait *Using your own technique produces really original results. Science fiction writer Arthur C. Clarke seen through a large fresnel lens*
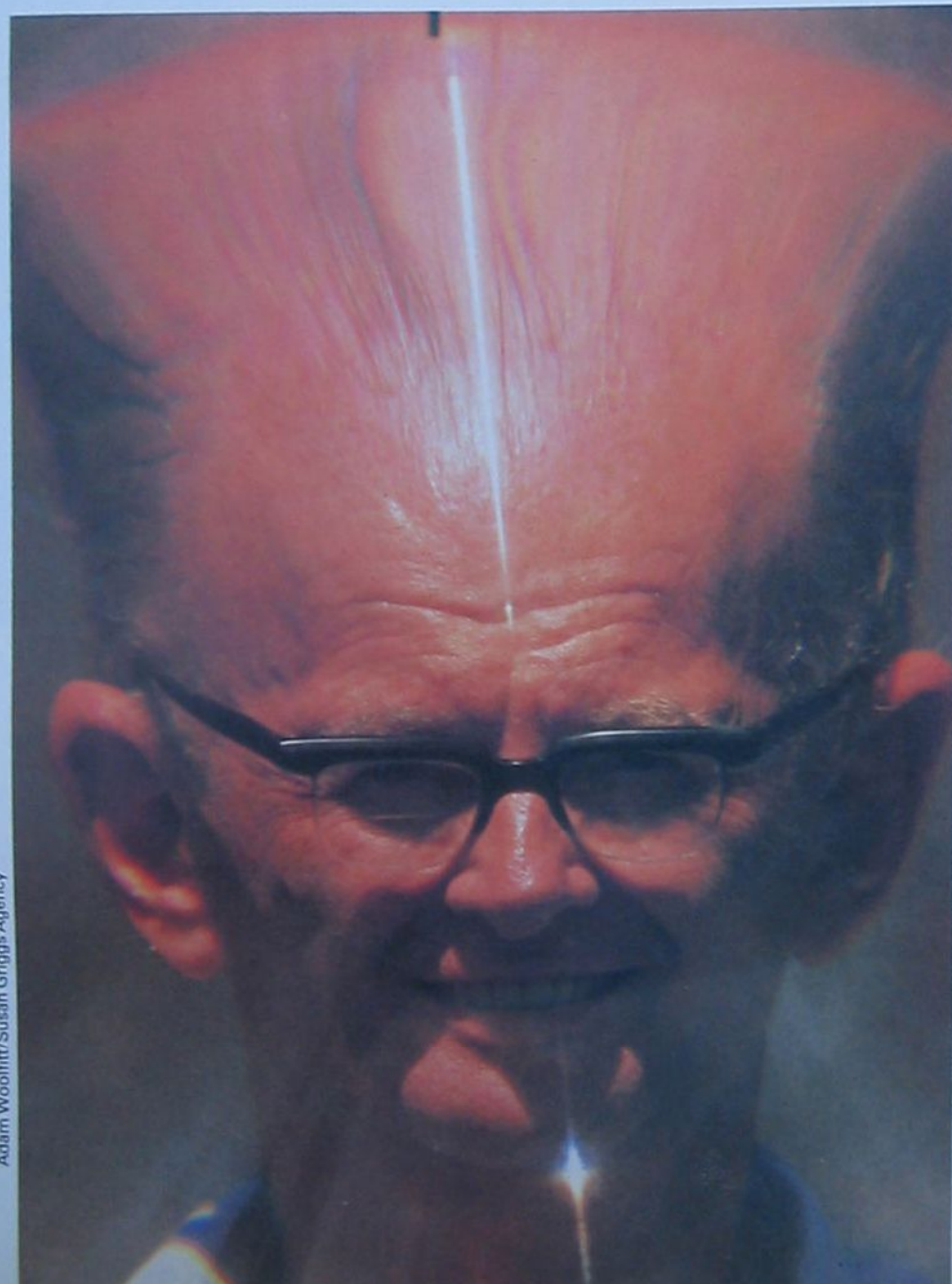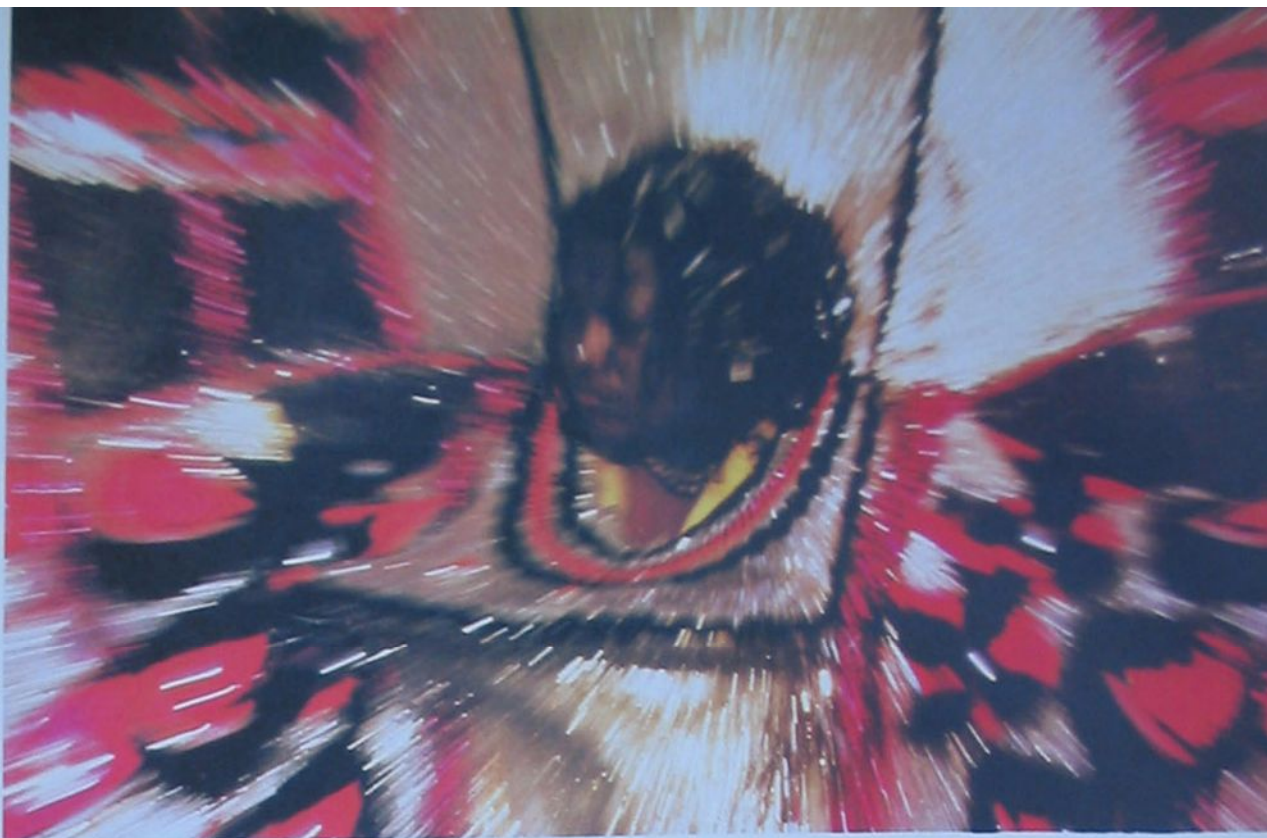
toadstool' simply by shooting from close to the toadstool with the friend a long way back, perhaps on a table. Great depth of field will be needed to get both images in focus, and a tripod both helps with this and with the precise positioning which is essential for a convincing result.

You can also use distortion to capture the effect of movement on film and to create the illusion of movement when it does not actually exist. There are many combinations that you can try out, such as panning with a moving object during a long exposure, combining flash with a long exposure, or just leaving the shutter open to give a blur. For an object that is static you can zoom in or pull focus to create impact, or you can make speed lines by panning and then using flash or a short exposure to show the object. Multiple exposures, too, can be used to create the illusion of movement.

Some types of modern film and equipment are so ideally suited to distortion that they make it virtually impossible not to get strange results. Very wide angle lenses for example, from fisheye to 20 or 24 mm offer great scope for upsetting our normal view of perspective. With their great depth of field they allow you to get very close to a small foreground object and make it dominate the picture, while keeping the background in sharp focus. These ultra-wide lenses tend to bend straight lines and, aimed at objects which we know to be straight such as tall buildings, cannot help giving unsettling results.

Infrared film gives eerie unnatural colouring with almost any subject but is particularly effective when used for subjects such as plants and landscapes, registering green vegetation as a lurid pink.

Polaroid SX-70 film can be used to give distorted images in a more selective way

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than is possible with most methods. By pushing the film emulsion around before it hardens with a blunt object such as a pen tip, it is possible to distort all or part of the image. Try distorting one building in a straight landscape or one face in a group portrait—the results can be very dramatic.

If working with colour it is best to do most of your distorting in the camera as there is relatively little scope for distortion afterwards. One exception to this is repeated duplication of slides to increase the contrast, or even duplicating a small section of the original transparency to increase the grain. You could, for example, take an ordinary landscape with a good range of colours and duplicate it one or more times. Each duplication decreases the sharpness of the image and at the same time increases

both contrast and colour saturation, and by repeated duplication you can make even a nondescript landscape look like something out of science fiction. Blowing up a small section of the original transparency to heighten the graininess can give very good results but it is a good idea to start with a transparency shot on high speed film, as slower films such as Kodachrome have virtually invisible grain even when enlarged (see page 2117 to 2121).

When working in b & w there is virtually as much scope for distortion in the darkroom as in the camera. By control of development time you can increase or decrease both the contrast of your negatives and the effect of grain. Both these elements can be further accentuated while printing, using hard or soft grades of paper and blowing up

small sections of the negative.

In addition, you can print with the negative and the paper out of parallel. At its simplest level this can mean no more than raising one end of the baseboard to make parallel lines diverge but it is also possible to bend the paper into strange shapes before projecting the image onto it. If you are using this technique it is best to stop the enlarger lens right down to give increased depth of focus.

There are many familiar methods of distorting the image in the darkroom such as solarization, bas relief and the use of lith film to cut out all intermediate tones, and while these can be difficult, a determined process of trial and error will often be rewarded by dramatic results (pages 914, 1208 and 1358). But it is often the most subtle distortion that creates the most satisfactory pictures.

Nude *There is no limit to the distortions that can be produced by curved mirrors. They generally achieve the most effective results with objects whose shape is familiar*

Stretched *This kind of elongated image is the result of using an anamorphic lens. Popular in movie photography, such lenses require adaptors for still cameras*

Understanding...

Hyper-sensitization

When astronomers are faced with hour-long exposures at the telescope, they want to make sure that the emulsions are working as efficiently as possible. Hypersensitization brings emulsions to their ultimate sensitivity

These days, film emulsions are so much better than their predecessors that most people are happy to use them as the manufacturers sell them. The only common alteration is to increase the processing time so as to raise the effective speed, and this is generally adequate. But for some users, even the best modern emulsions are quite inefficient—for those who wish to use them for long exposures, particularly astronomers. The problem is low intensity reciprocity failure (see page 466)—the inefficiency of halide grains at recording photons that arrive at a slow rate.

But these users have for many years taken the reciprocity law into their own hands, and a variety of processes are used to improve the performance of emulsions at low light level—that is, to *hypersensitize* them. Some of these methods could be of use to the everyday photographer confronted with lack of light, though some require special equipment.

There are several causes of reciprocity failure, all stemming from the poor growth rate at low light levels of the silver specks which form a latent image. Thermal effects cause photoelectrons to leave the site where a speck is to be found, and some emulsions can be damaged by contaminants. Unfortunately, the important contaminants include moisture and oxygen, as well as the vapours from paper and cardboard, oils, some types of rubber and plastics and many paints. All these should be kept away from the emulsion before and after it is used—a virtually impossible task. Film manufacturers use various restrainers in the emulsions to overcome the effects of these contaminants, otherwise films would rapidly fog in storage. Hypersensitization (hypering) aims to remove these restrainers,

to keep the effects of the various desensitizers to a minimum, and to bring the emulsion to its peak sensitivity. Hypering methods can be divided into three main types—physical, optical and chemical.

Physical methods

As film is cooled the thermal decay of the latent image drops considerably, so that at dry ice temperatures it can be almost nil. The results from a film exposed at these temperatures can be very good and frequently the best obtainable in any single hypering technique.

The main reason why the idea is not adopted more often, even by astronomers, is the practical difficulty in making large cooling chambers for astronomical plates which do not suffer from condensation. Consequently, the method is most popular among amateurs using 35 mm or 120 format cameras where condensation and dewing on the optical system can be kept at bay. The modern astronomical films do not respond too well to cooling because low intensity reciprocity failure in them has been reduced to a minimum. Results with ordinary Tri-X, however, are claimed at over one stop at −68°C.

One way of stopping condensation on the film is to place it in an evacuated chamber. And under vacuum, a quite useful degree of hypering takes place, even without cooling. The effect is assumed to arise from water and oxygen removal which is the basis of all the important hypering techniques.

A high vacuum is not needed. The critical factor is the speed of application. A slow removal is often better as some gelatins subjected to high vacuum may form an impervious coat when water is removed too rapidly, and this can trap oxygen and water vapour lying deeper in

Night shot *This was taken on Ektachrome 400, normally processed*

Hypered *The exposed film was left with a mercury drop for 48 hours*

the emulsion. This is why some professional films recommend a standard humidity.

If you want to try simple hypering it is worthwhile experimenting with film kept under moderate vacuum for a few hours or longer. A usable film speed will result but it will be unpredictable depending on the film batch. Expose and develop the film immediately after treatment and use the same film batch for consistency.

Since it is inconvenient to expose a film in a vacuum chamber and much of the good work is undone on loading the camera in air, it is better to replace the natural

oxygen and water by something else. Nitrogen has been found best.

A simple variant of this is to repeatedly replace air with dry nitrogen. The gas must be at least of White Spot quality or guaranteed oxygen free. The speed gains can be considerable, with exposure times reduced from an hour or so to several minutes.

The main importance of vacuum or gas hypering lies in their use as a combination or preliminary to other treatments, of which baking is the most common.

Baking

If a film is heated gently, under the right conditions,

Michael Maunder

water is evaporated. On evacuation the residual gas comes off as well. By baking the emulsion in nitrogen all the volatile contaminants can be driven off and the film can then be stored for long periods at atmospheric pressure in nitrogen, cooled if needed.

The advantage of baking is that many of the restrainers put in by the film makers are removed. In effect you are accelerating the emulsion ripening process. Afterwards the film will deteriorate rapidly so it is seldom worth taking a film through the process more than once. Baking temperatures have to be found by experiment, but 65°C is the normal limit with times of several hours.

If baking is taken too far the film will fog. A practical example of this is seen if a film is stored too long at too high a temperature as in a car glove box of a black camera left in the sun.

Orion Nebula *A ten minute exposure on normal 2415 film*

Hydrogen treatment

The latest idea is to soak the film in hydrogen gas after nitrogen storage or evacuation, and maybe even after baking in nitrogen. The improvement over a simple nitrogen baking is sufficiently worthwhile to overcome the extra complication and danger, as it seems that a small amount of oxygen stays in the emulsion even on evacuation.

The exact way in which

Hypered *After hydrogen soaking for seven hours at 40°C*

hydrogen soaking works is still unclear, but it probably combines with oxygen and sulphur compounds. The effect is to produce sensitizing compounds, which may make the emulsion rather liable to fog if the process is overdone.

Hydrogen is notoriously unsafe, but because only a small amount of hydrogen is needed an 8% hydrogen in nitrogen mixture is often used. This is called *forming gas* and is perfectly safe. Because forming gas is weaker than pure hydrogen, baking at about 65°C is also needed.

Optical methods

The simplest technique has been used for a very long time. The mechanism of preflashing is to supply enough photons to form sub-latent images large enough to be relatively stable against thermal decay. This is about three to four photon events per developable site. Subsequent low level light is then absorbed more readily.

Preflashing can only be used where the background density is very low—in astronomical terms, where the skies are very dark. In bright night skies, as in moonlight, preflashing occurs automatically.

Chemical treatments

The only effective way of hypering some specialized infrared films is by some chemical treatment. Without this their storage life is too short and exposure times too long.

A very wide range of ideas have been proposed and they all need a high degree of skill. Briefly, the film is bathed in water or a water solution of some chemical and carefully dried before exposure. The concentration

of chemical, time of bathing and the drying method can all have an effect. The process is not recommended except under strictly controlled laboratory conditions.

The normal chemicals for this are alkalis like ammonia or very dilute silver nitrate. The silver nitrate process is the only one also recommended for visible light films such as Technical Pan 2415. The speed gains are comparable with gas treatment but the film shows up any finger or stress mark making it somewhat impractical. Hypering in this case is said to arise from the removal of excess halide ions in the emulsion.

Vapour treatment

This used to be quite common before World War 2. Mercury was the most popular vapour: a small drop of mercury was introduced into the film container and the vapour rapidly percolated the wrapping paper or cassette so no extra handling was needed. After a day or two the film was ready.

Advantages claimed were the simplicity and that the colour sensitivity and curves were unaffected. And the process could be repeated as needed if the film was not used first time. The technique fell into disuse with the advent of modern fast films. It was believed that it worked by mercury deposition on sensitivity centres in the emulsion. These days the film manufacturer adds a variety of metallic sensitizers, such as gold, to the emulsion.

Another reason for the demise was the variability of the effect, probably due to poor airtightness of the containers. Today, mercury is regarded as a bad poison and is difficult to buy. It must never be allowed to come into contact with aluminium, nor with most metal cassettes.

Mercury hypering is still important, however. If you are experiencing variable results in the darkroom, particularly with colour papers, suspect mercury. Check that you have no mercury anywhere on the floor. Make it a habit never to take a mercury thermometer into a darkroom because they are easily broken. Mercury effects are cumulative, both to you and the films and papers stored in a confined space such as a darkroom.
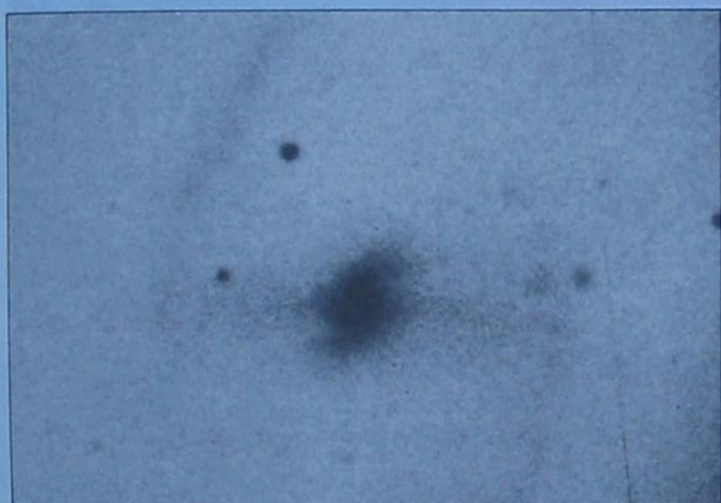
Spiral galaxy *A 90 minute exposure on fast infrared emulsion*
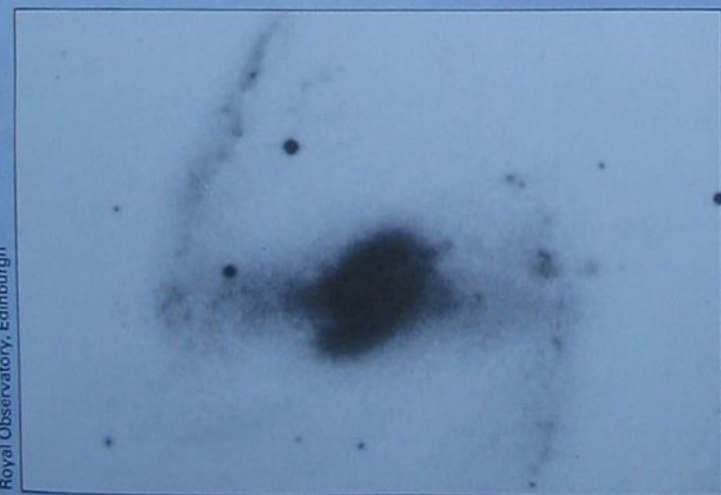
Hypered *A slower infrared emulsion, soaked in silver nitrate*

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Shooting interiors

Taking photographs of a room involves more than just switching the room lights on and snapping away. If you want the location to look its best, it is essential to take some care over your approach, particularly the lighting

Imagine yourself sitting in a room on a sunny day. You look out of the window, and your eye can see details in the brightest sunlight. At the same time, you can also see details in the darkest corner of the room. But if you take a photograph of what your eye sees, the outdoor scene will be overexposed, or the indoor one underexposed, because photographic emulsion can record a much narrower range of contrast than the human eye can perceive. The art of lighting interiors is to compress the range of contrast to what the film can record.

Shooting by available light

Some scenes are lit perfectly adequately and evenly by the available light. Even if the light is not sufficient for a hand-held shot, you can often get good results by using a long exposure on a tripod, without resorting to additional lighting. Careful placing of the camera, particularly keeping windows out of the shot, can help to avoid excessive contrast

ratios. This technique often gives very natural looking results, which can capture the atmosphere of a place better than many harshly and artificially lit shots.

There are a few precautions to take when using the long exposures needed for this technique. The main concern is the exposure itself, and the problem of reciprocity failure. Most films are manufactured with an optimum exposure time, and the film speed is calculated at that exposure time.

Reciprocity failure is particularly likely with daylight films. For most daylight films, the manufacturers expect the film to be exposed at about 1/125

The drawing room *was shot using both flash and available light—daylight and room lights. Eight exposures were made on the same sheet of film, with the room lights left on for five of them*
Church light *The large windows and light interior allowed the church to be shot by available daylight alone*

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Daylight only *With just the light coming through the windows, the room looks fairly attractive. But there are many areas, such as the far corner, where detail is hidden in shadow*

Colour cast *With very long exposures, the picture can have a cast due to reciprocity failure. Here a 15 second exposure was made on Ektachrome 200, giving a very green picture*

second. When the exposure times are much longer, the film becomes less efficient at recording light and its colour balance changes. To gain an accurate and well-exposed result with extended exposures, filtration may be needed (see pages 466 to 467).

Because of the high risk of reciprocity failure with daylight films, it is often better to shoot on tungsten film even when the available light is natural daylight. Tungsten films are designed for studio use, and are therefore more suitable for long exposures—manufacturers expect exposures in the order of ½ second. But when they are used in an interior lit by daylight, the emulsion has to be converted to daylight use with an 85B filter.

One of the big problems with shooting interiors on colour film is colour balance. With daylight alone, an 85B filter with tungsten film is quite adequate. But when artificial light sources are included, the problems are more complex.

Many large interiors have built-in floodlighting which provides excellent illumination, provided you can tell the colour temperature of the lights used. Tungsten halogen lighting is commonly fitted to interiors like cathedrals and here it is advisable to shoot on tungsten film. The floodlighting is often rather lower in colour temperature than the 3200K for which tungsten film is balanced and this gives a reddish result unless some blue filtration is used.

For really critical colour rendering, a colour temperature meter will tell you what colour the lights are burning at, and some even tell you what filtration to use.

Fluorescent tubes pose a particular problem, as their colour temperature varies from type to type (daylight, warmlight and so on) and changes with age. Some colour meters will give colour temperature readings for fluorescent tubes, but these are rare. However, if you know the make and type of tube, tables provided by Kodak will suggest a filtration. As a starting point some filter manufacturers supply filters for convert-

ing fluorescent to daylight—but it is wise to do a test if the results are critical.

Mixed lighting is even harder to cope with and it is best to avoid it if possible. If you are shooting in tungsten light, for instance, pull the curtains over the windows or wait till darkness. Alternatively, frame to exclude windows from the shot altogether.

Establishing the exposure

Whatever type of lighting you are faced with, and whatever film you are using, it is sensible to bracket the shots by at least one and a half stops either side of the meter reading. There are so many variables with these types of shot that it is often difficult to gauge the exposure accurately. When taking the meter reading, take care to keep any bright windows out of the view of the meter, as these will distort the reading. Aim instead at the floor, or some mid toned area within the shot. If your meter can read incident light, a reading from the centre of the room, pointing towards the

Available lighting *Switching the room lights on gives an improvement on daylight alone, though it is still not ideal. A 10R red filter was used to compensate for slight reciprocity failure*

Just flash *Four flash units were used in all—three at the far end of the room, to the right of the camera, and a snooted one on the left. This shot shows how the flash contributes to the main shot*

camera may be extremely useful.

As a starting point for bracketing, it is common practice to take an incident light reading, then a reflected reading from the floor, and split the difference. A spot meter is useful for measuring the range of contrast between the brightest and the darkest areas. If you do not have a spot meter and your camera has TTL metering, you can use your camera as a spot meter by fitting the longest lens you have. If the meter tells you that the brightest point needs an exposure of 1 second at $f/16$, and the darkest area is 1 minute at $f/16$, then you have a range of seven stops to cope with, which is outside the range of many films. For a satisfactory exposure you need to throw some light into the darkest areas and bring them up to within about four stops of the highlights.

Using flash

A great deal can be achieved with hand-held flash guns. Unfortunately, however, a single flash usually lacks sufficient power, so a system of multiple flashes is called for.

With a typical subject—a room with coloured walls, a white ceiling, a dark carpet and a dark sofa along one wall opposite the windows—an incident light reading, taken in the middle of the room, might give an exposure of eight seconds at $f/11$. Spot readings tell you that the areas nearest the windows need two seconds at $f/11$. If the exposure is made according to the incident reading, the lighter areas will be highlit, but not bleached out. The readings for the sofa and carpet indicate three minutes at $f/11$, which is more than three stops below the general reading. If the available light is not supplemented, shadow areas will lack detail, so the floor and sofa need additional light. With hand-held flashguns this seems impossible—the sofa is three metres away, but at three metres your flashgun will only yield an exposure of $f/4$. What you need is $f/8$—one stop less than the incident reading. By keeping the level of fill-in flash about one stop less than the general incident reading, the result will be more natural.

To get your flashgun to yield an exposure of $f/8$, you need to get four flashes out of it (one flash gives $f/4$; two flashes give $f/5.6$; four flashes give $f/8$). But your flashgun takes ten seconds or more to recycle so four flashes would take 30 seconds, almost four times as long as the total exposure indicated by the incident reading.

The simplest solution is to make a multiple exposure, using one exposure for each flash. Unfortunately, most cameras do not have a suitable multiple exposure facility. The answer to this problem is to cover the lens while the flashgun is recycling. For this you need a piece of black card, as matt as possible, which you simply hold in front of the lens during the recycling process. So to take the photograph in the example above, you cover the lens with the card, open the shutter on the B setting, remove the card and immediately fire the flash, then quickly cover the lens again. When the flash has recycled, you repeat the procedure.

After four flashes you have built up the fill-in lighting, and you can give the film its time exposure. A stable tripod will help to prevent the camera being jogged as the card is moved in and out of place.

If you have more than one flashgun, you can place your extra guns where they will lighten up dark corners. Position them carefully and if possible trigger them with slave units so that no flashguns or cables appear in the frame.

To avoid harsh shadows from the gun nearest the camera, you can move it around slightly from one flash to the next.

Best combination As there was daylight coming through the windows, daylight film was used, with tungsten lights converted to daylight using blue filters

An umbrella reflector on each gun will soften the results even more—but will also reduce the power of the flash and, unless you have a flash meter, brollies make it difficult to assess the output. The disadvantages of this system are that your arms begin to ache holding the card still in front of the lens and, more seriously, the overall lighting effect cannot be seen at the time you are taking the shot. One of the flashguns, for instance, might be reflecting in a mirror.

To control the flash lighting properly, you really need professional studio flash heads with modelling lights. Unfortunately these are expensive and considerably bulkier that flashguns. But they have a higher output, allowing the use of diffusers and umbrellas, and they recycle faster, usually within a second or two. However, even with studio flash heads it is usually necessary to give several flashes.

Fast shutters

On some occasions you need fast shutter speeds and several flashes—for example, where you are taking an interior photograph where you also want to record the view out of a window.

Take a case where the exposure for the outside view is 1/60 second at $f/11$. Your flash heads may give, say, $f/5.6$ for one flash, but $f/5.6$ does not give you enough depth of field, and you really need to use $f/11$. To get to $f/11$ you need four flashes; but you can not cover and uncover the lens with black card fast enough—with this technique the exterior will be hopelessly overexposed. One answer is to take four exposures of 1/250 second each at $f/11$, with the flash firing each time.

Flash fill With no additional lighting, windows have too large a brightness range to record on film without losing detail (far left). Using flash allows you to expose for the outside scene and still show interior details of the room

Too orange *This is similar to the previous shot, but without converting the lamps to daylight, resulting in an orange cast on the parts lit by tungsten*
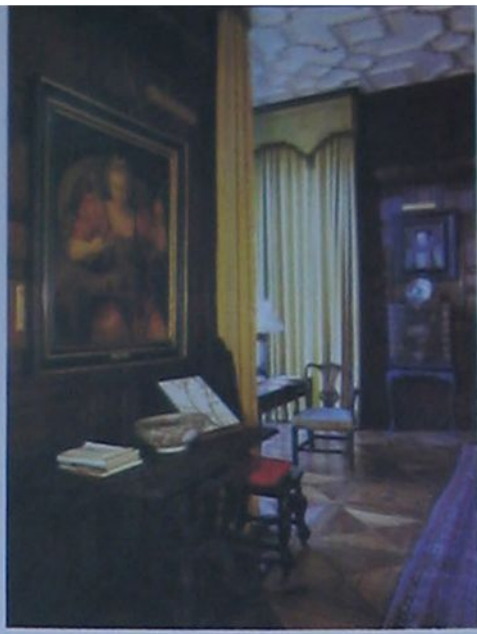
Too blue *Switching to tungsten film gives the correct balance for the lights. But those areas lit by the daylight are far too blue*

Just lights *By excluding the daylight the scene is lit by the unfiltered lights alone. On tungsten film this gives correct colour rendering*

A shutter synchronized at 1/250 second is needed. Unfortunately, few 35 mm cameras have this facility—which is one of the reasons why professionals tend to do this sort of work on larger formats.

You also need to be able to recock the shutter without advancing the film, or jogging the camera. Large format cameras have lenses with their own shutters which are fully synchronized, and it is possible with care to recock the shutter by hand without jogging the camera. But it is safer to use a shutter like the Prontor Press which is self-cocking via a cable release.

An alternative method is to rig up a remote controlled servo motor to recock the shutter and to fire it from across a room, or even from the other end of a cathedral. This system has the advantage that the photographer can move the lights around between flashes, without going near the camera.

Balancing the light

Even with modelling lights it is hard to be certain what the balance between the daylight and the flash heads is going to be. A Polaroid back is invaluable for checking the lighting ratios.

Often there are light fittings, such as chandeliers, which are part of the decoration and should be illuminated. But if they are on for all the exposures they would be overexposed. The solution is to leave them switched on for only half the total exposure.

In exceptional cases where a really massive flash output is needed—in photographing a cathedral nave with a dark roof, for example—blue flashbulbs can be used. A special unit can fire up to four bulbs at once. The bulbs themselves are comparatively expensive and have

Radio City *To keep the atmosphere of the place, tungsten lamps were used as the main light source, so that they matched the available room lighting*

to be changed for each shot, making bracketing time consuming and costly. But they have the advantage of being lightweight, with a high output, and they are independent of the mains supply. Individual bulbs can be fired with slave units, and very complicated lighting set ups are possible but this approach means carrying many bulbs around.

Using tungsten lighting

Flash lighting is invaluable for colour work because its colour balance matches any daylight coming into the scene. But if you are working in black and white this is no longer a consideration, and any type of lighting can be used. It is best to avoid negatives that are too contrasty, so with black and white it is advisable to overexpose and under-develop the film. Tungsten lighting has several advantages over flash—it is cheaper and lighter, you do not need a

special flash meter, and you get what you see. This is particularly useful for avoiding reflections in mirrors, picture frames, or even just glossy paintwork.

There are various types of tungsten lighting suitable for interiors, from photofloods in inexpensive reflectors to high intensity quartz iodine or tungsten halogen lights. With all these types, diffusers can be used in front of the light.

Tungsten lights can be converted to daylight for use with colour materials, but there is a big loss of output. Blue gelatin filters, or a blue reflector can be used; and some lighting equipment manufacturers supply glass dichroic filters, which are heat resistant. If tungsten lighting has to be used, and it is not practical to convert it to daylight, then it may be possible to exclude any daylight from the shot, and work entirely on tungsten film. You may even have to wait until dark for some shots.

NATIONAL GEOGRAPHIC

With 11,000,000 subscribers, up to 60 photographers and a policy of buying Kodachrome in batches of 30,000 rolls, the 'National Geographic' Magazine has a wide reputation as one of the world's foremost showcases of photography

Joseph F. Rock/National Geographic Society

The yellow covers of *National Geographic* magazines are a familiar sight on the bookshelves of homes and libraries. *National Geographic* gives a unique view of people and places all over the world through a wide variety of illustrated articles. Indeed such is the success of the magazine that the number of its subscribers has grown to nearly 11,000,000 in the last decade.

National Geographic was founded in 1888 as a largely scientific journal produced for the American National Geographic Society. Although still financed through the Society's membership fees, *National Geographic* has become a more popularly orientated magazine which is still an authorative reference source on subjects as wide-ranging as travel, anthropology, wild life, industry, agriculture, archaeology and modern scientific developments.

Well-known for the clarity and depth of its articles, the hallmark of the magazine is its consistently high standard of photography—*National Geographic* developed a visually orientated bias very early in its life and was also the first American magazine to publish colour photographs.

This photographic reputation is still maintained and to keep the magazine

Dancing demons *in a Tibetan lamasery. One of a series of unique colour photographs taken by Jopseph Rock during a two year stay in Tibet in the mid 1920s. Published in November, 1928*

'I am four' *A charming reply to Dean Conger's faltering Russian question. This image was taken on one of Conger's visits to the USSR for his photoessays for Geographic*

Portrait *of a Chinese man taken by Bruce Dale during a visit to China. Geographic photographers may have to shoot anything from portraits to landscapes*

supplied with illustrative material, up to 60 photographers may be employed at any one time—usually about 16 on the staff with the rest employed on a freelance basis. Together this team produces about 1,500,000 images every year. Just a few of these transparencies will end up in the journal or in a *National Geographic* book. This published material together with a selection of unpublished transparencies are subsequently placed in the Society's illustrations library—joining nearly 11,000,000 others. This huge photographic operation is supported by the Society's subscriptions, aided by the non-profit status of *National Geographic* which means that its capital is ploughed back into the magazine as well as funding various research projects.

The long route from the initial idea for a feature to its publication begins with a planning council every two months attended by 15 to 18 members of senior staff. In the preceding four weeks a large number of feature proposals will have been made by members of staff and by freelance contributors. These proposals are passed on to specialists in the various areas involved and 30 to 50 of them are then recommended to the planning council. Of these only three or four will eventually be approved and passed on to the research stage.

Once the idea has been given the go-ahead, one of a dozen picture editors on the staff is assigned to the story, together with a writer and a photographer. In many cases the person who suggested the story will be assigned to work on it, but *National Geographic* also employs a number of specialists. Some photographers have particular language skills

Dean Conger/National Geographic Society

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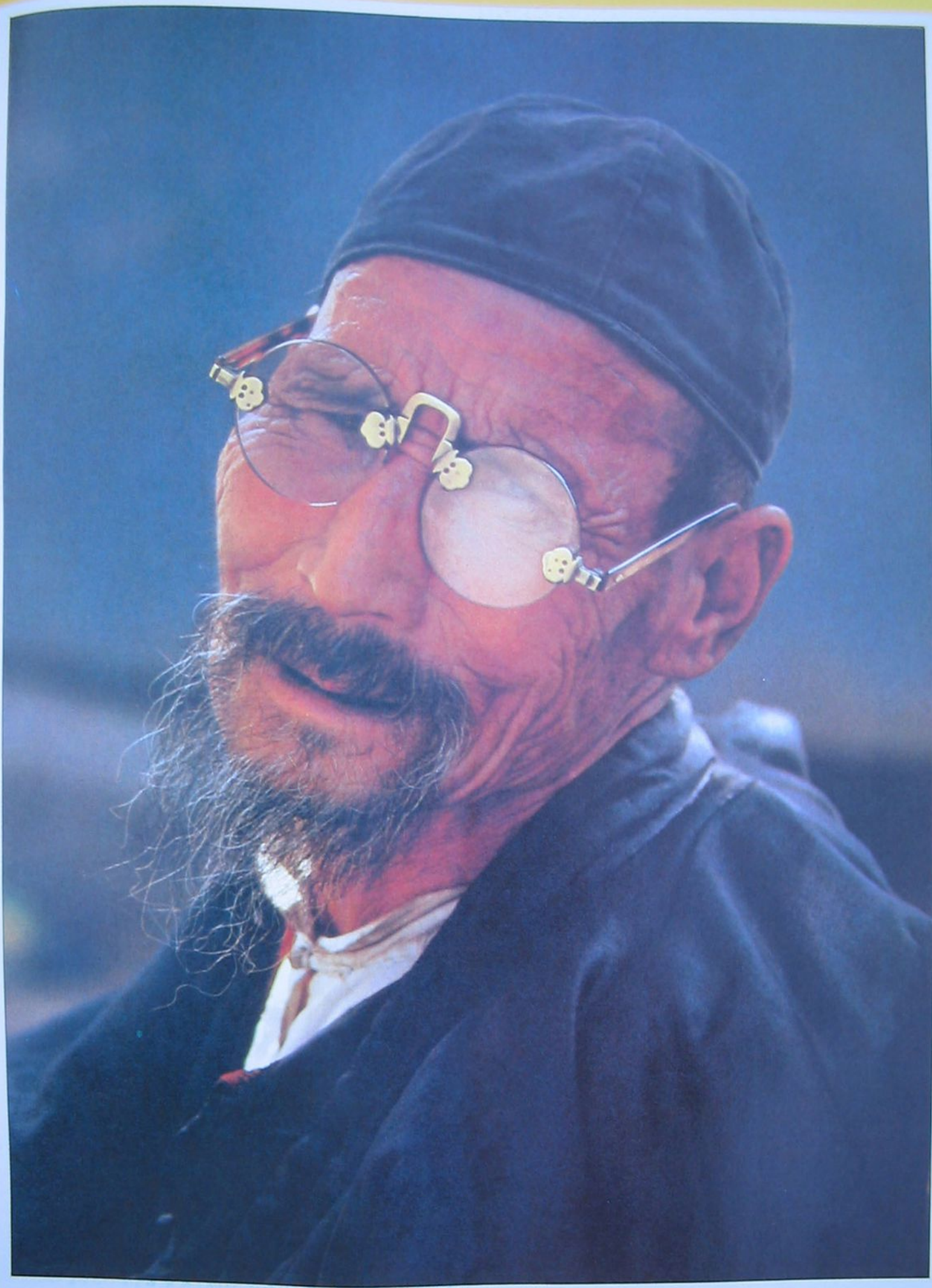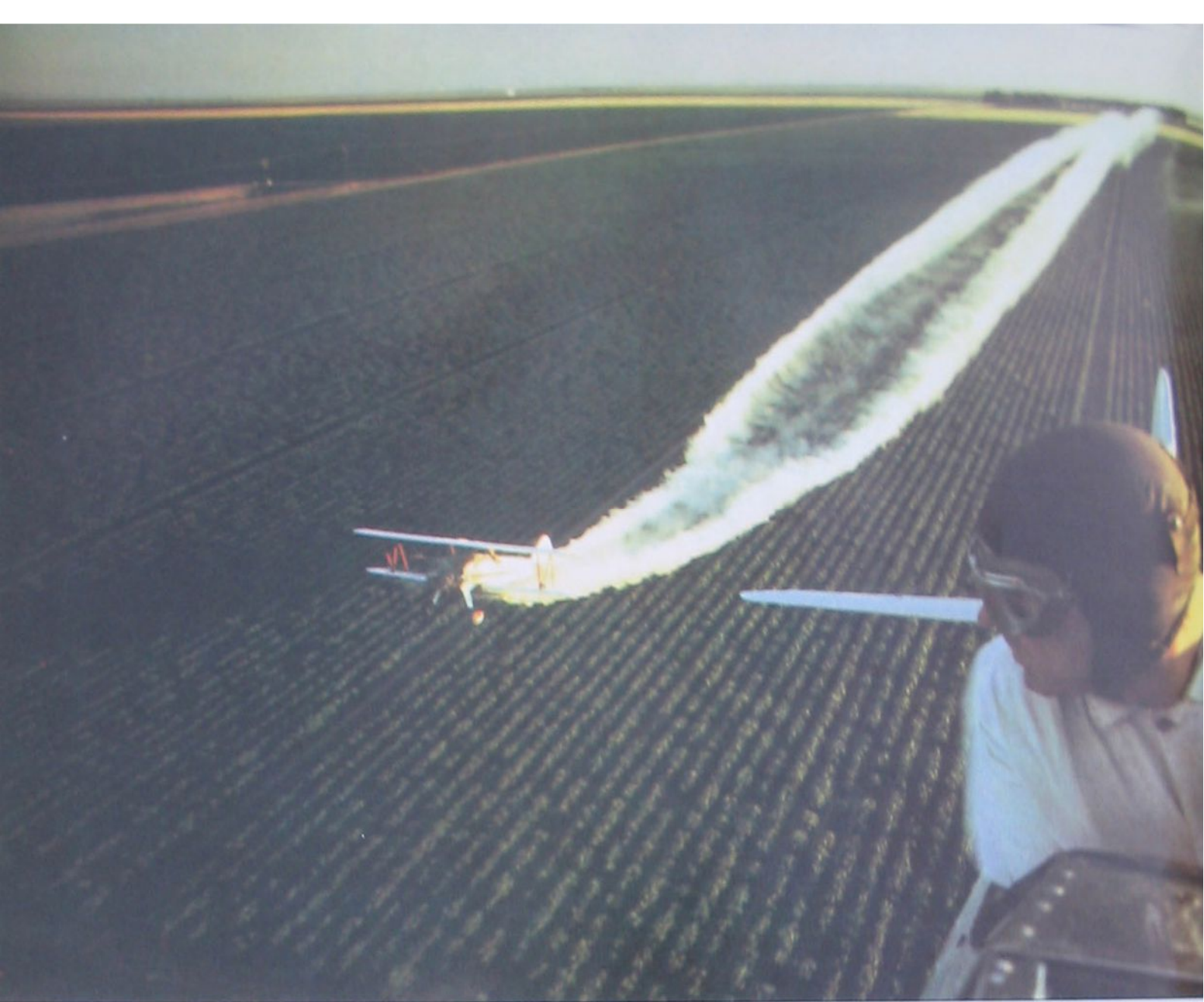
while others may specialize in underwater work, mountain climbing or have a particularly good working knowledge of a country or region. These all play an important role in deciding which photographer should be assigned to a job. However, there are also more immediate considerations, such as who is available at the time or whether or not all the staff photographers are being kept busy. Most of *National Geographic's* photographers are equipped to tackle almost any kind of assignment—many of them began as newspaper photographers and have become accustomed to covering anything from riots and murders to births and weddings.

After preliminary research, a story conference is held in the editor's office with the writer, photographer and picture editor proposing a basic theme and approach to the story. Another important consideration that is dealt with at this stage is how to keep the story on a manageable scale, particularly if it is global in nature such as a feature on a crop or a mineral. The outcome of the conference determines the way the project begins, although there may be a

Robert W. Madden/National Geographic Society

need to modify the approach after experience in the field.

Unless there are special circumstances—such as travel restrictions or if the team are following a particular expedition—the writer and photographer work separately. Writers may often be able to complete their work in six weeks but photographers generally need two or three months—or even longer. A photographer working for *National Geographic* is part of a huge editorial team and operates with the backing of a large budget, together with a sophisticated research team and up-to-date technical facilities. Photographers are given the freedom to make their own interpretations of the subject and the time to make sure that all ground is covered and all important shots done in the best way possible. The quantity of film used is hardly important.

If tens of thousands of dollars are being spent on a project, the cost of the film is secondary and no one will complain if a feature takes 300 rolls of film—or even 500. It has been known for photographers to get through over 1000 rolls—and even that does not seem outrageous for a magazine which buys its Kodachrome in batches of 30,000 rolls.

Crop spraying *Thomas Nebbia spent many weeks planning this spectacular shot of crop spraying over cotton fields in California*

A deadly spray *flies into the safety glasses of this cobra's handler and is frozen by Robert Madden's high speed strobe lights*

Kayak odyssey *A small group of American and English canoeists paddle by the gates of a Shinto shrine at Itsukushima on Japan's Inland Sea*

Not all the photographs taken are even intended for publication. Many are taken solely for information—as artists' and manufacturers' references or as visual notes for the writers.

Some people feel that with such facilities backing them, a *National Geographic* photographer can hardly fail to make exciting pictures while working in some exotic location. The offices of the magazine are constantly being besieged by eager photographers who feel that they could do as well as anyone they have on staff. But often people fail to take into account the astounding logistics frequently involved in a *Geographic* assignment. Or else they underestimate the difficulty that can be experienced when a photographer is trying to combine aesthetic qualities with an image that also conveys a lot of information.

Almost every photographer who has done an assignment for the magazine has a story to tell which illustrates the amazing problems which can arise on the job. These problems may range from coping with harsh climatic conditions, repairing motor vehicles without the proper tools and equipment, arranging fuel caches to simply dealing with people from a completely different culture and speaking a completely different language. Robert Gilka, Director of Photography, outlined the essential qualities of a *National Geographic* photographer as being dedication, resourcefulness, innovation, courage and sensitivity.

Even before going off to take the photographs, the photographer may have to bring his or her skills to bear on the problems of making arrangements. And these may be considerable in some of the more sensitive areas of the world. Dean Conger, Gilka's assistant, took the

Thomas Nebbia/National Geographic Society

Christopher G. Knight/National Geographic Society
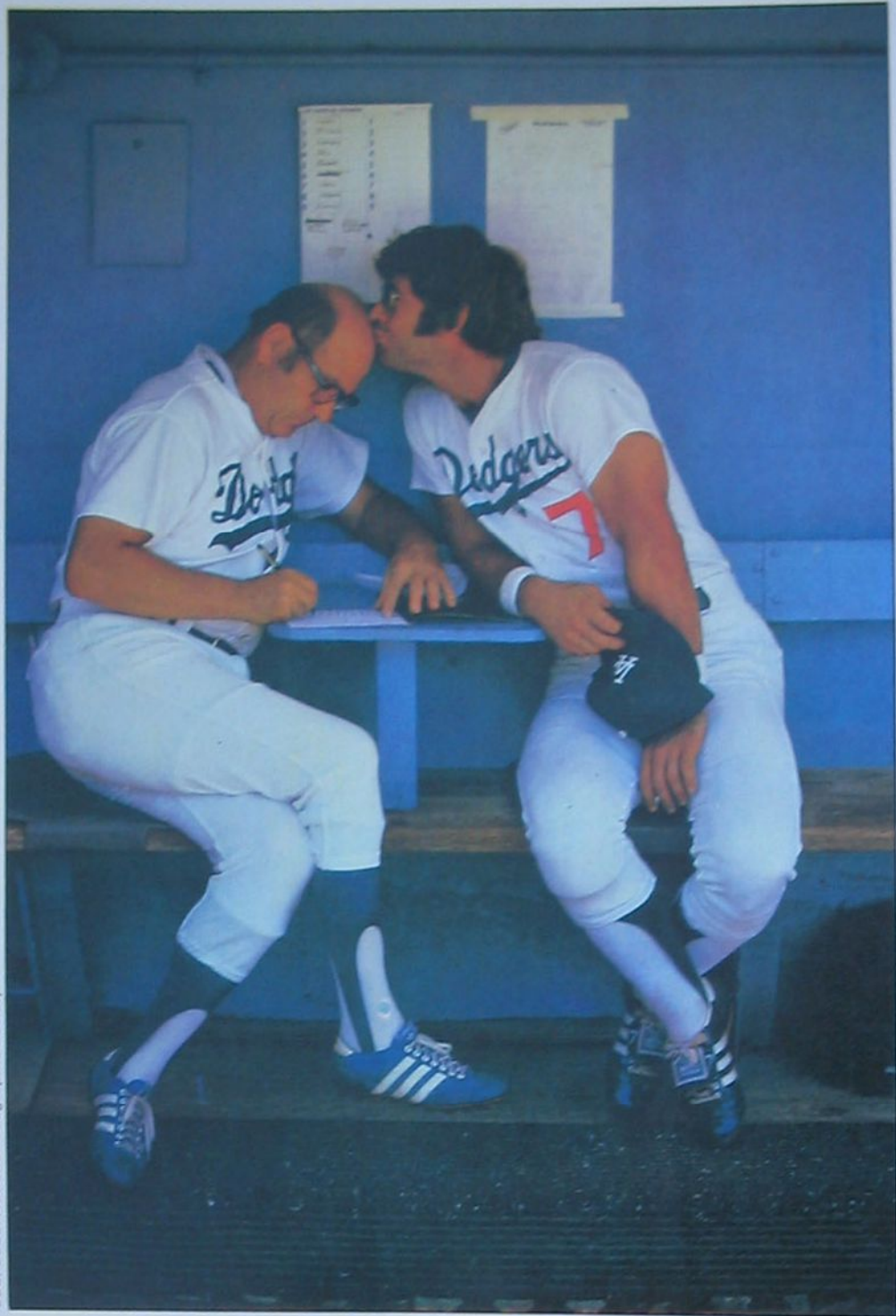
pictures for two articles and a book which *National Geographic* published on Russia. The project took five years to arrange and another five to complete. However, as he explained, Conger had the satisfaction of making all the original negotiations with the Soviets and finally making the pictures that were needed. 'We started talking to the Soviets in 1968 and we went on the first trip, together with the editor, Gilbert M. Grosvenor, in 1972. But we didn't get an agreement—we came back empty handed. I went again in the fall of 1972 and came back empty handed. We waited a year and then the writer Bob Jordan, the editor and myself returned in December 1973 and finally got permission . . . I made six further trips on the book which came out in 1977.' With a total of 29 trips to the USSR, Dean Conger illustrates the way

Geographic photographers can become experts on a particular country.

Once on asignment, whenever communications allow, photographers keep in touch with the offices in Washington, D.C. They will also send back regular batches of exposed film. This is processed, and a technician studies it to make sure that all is going well with the cameras and that there are no problems with exposure or focusing. This technical report is then sent back to the photographer—one for every batch of film sent to Washington. The film is also checked by the picture editor assigned to the project to ensure that the photographs suit the story. Tom Smith, Illustrations Editor, expanded on this important role, 'During the time the photographer is in the field, the picture editor becomes his or her eyes. The
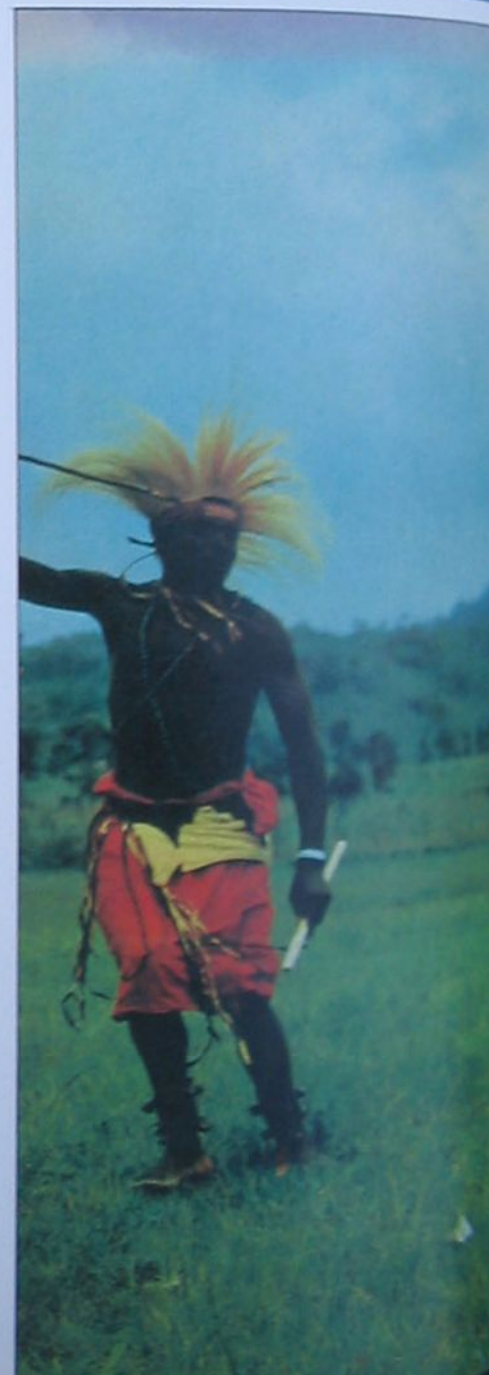
Dodgers at play *Jodi Cobb shows that Geographic photographers must always be ready to grab the unusual shot that gives a fresh angle to a story.*

Windsor Park *Luck also helps—Stanfield took this picture at the gates of Windsor Castle but only realized afterwards that he had caught Prince Philip driving the four-in-hand.*

Impromptu dance *by Ugandan tribesmen. This was one of many that George Mobley saw performed on his travels from village to village across the East African bush*

picture editor tries to communicate to the photographer the results of the work, how he is progressing, often encouraging the development of further ideas, to let the photographer know that he has failed on something important and should perhaps reshoot it.'

This sort of dialogue is the ideal state of affairs, but often a photographer may be working in an isolated region where such regular contact is impossible. Under such circumstances serious problems can occur—the photographer could run out of film and have to contact the office for more—and authorities are not always happy to allow journalists to import large quantities of film. Some governments are also becoming increasingly suspicious of journalists and fear that their countries may be portrayed in a bad light—and this anti-journalistic feeling even applies to *Geographic* photographers. Sometimes, when working far from home, taking pictures is almost incidental. Most of a photographer's energy and time may be taken up with actual travel and basic survival or making arrangments in governmental offices or arranging to take shots from an aircraft or helicopter.

The temple of Bhagwati Karniji *Rats cluster round food offered to them as the reincarnations of the ancestors of local people. Lit by electronic flash*

There are also times when the problems that a photographer encounters are even more testing. James Amos, a staff photographer, once hired a helicopter to take aerial photographs of the Great Salt Lake in Utah. About 2,500 feet above the lake the control linkage failed, causing the helicopter to crash and killing the pilot. Amos was thrown clear but had to swim to shore with a broken leg. A few weeks later, while still in crutches, Amos finished his assignment by hiring a light plane. He reasoned that he had something to prove to himself. The problems may not always be so dramatic but the way the photographers respond to pressure is often similar.

When it comes to taking the pictures themselves, the high standards of the magazine put further pressures on the photographer. Robert Gilka described the demands made. 'Our image maker is expected to come back from Paris with a new, provocative look at the Eiffel Tower, or from Africa with a shot of the Victoria Falls to end all pictures of the Falls—at least until the next *Geographic* photographer gets there . . . Our photographers are expected to work without coloured filters, lenses that make multiple images, vaseline smeared lenses, textured screens, or any other such devices. They must perfect a pure technique involving only camera, lens, film, and a masterful sense of light and what it will do to make an ordinary subject something special.' In this sense, the photographs published in *National Geographic* are made not taken. Skill, sensitivity and planning are combined to forge together the elements of a scene into an attractive, memorable photograph that also accurately conveys the relevant information.

The basic job of any magazine photographer is to satisfy the demands made by the editor and, while a *Geographic* photographer has a degree of freedom in the way he or she works, the assignment has to be done so that it meets the high standards of the senior editors in Washington. It has been known for a full length feature to be completely reshot because the first attempt failed to meet the journal's standards of excellence.

At some point the picture editor and the photographer will agree that the story has been completed and the transparencies will be edited down so that a presentation can be made to a small group of senior editors who are responsible for the illustration of the magazine. No matter how many hundreds of rolls of film have been shot, Illustrations Editor Tom Smith is adamant that he will never look at more than 100 transparencies on a single feature. From this edit 30 or 35 photographs will be selected for use in the magazine. If the work was done by a freelance photographer, the remaining material becomes their property—all staff photographs belong to the magazine.

National Geographic photographers use 35 mm cameras for their work, a tradition which dates back to the 1930s when Luis Marden first exploited the combination of Leica cameras and Kodachrome film for the magazine. Now many different makes of cameras are used—although Nikon equipment is used more widely than anything else. The technical department is equipped to repair or supply almost any piece of Nikon equipment available as well as many pieces of equipment that could never be found elsewhere. Constantly in search of innovative ways of creating pictures, staff photographers have had special hardware designed to meet their needs—this may be a remote control system and camera housing to take photographs from the tail of a jet aircraft or a special underwater housing built to correct the optical effects of water. Another project which has been occupying *National Geographic* technicians is an electronic underwater camera that will go under a layer of ice and 100 metres of water and can be remotely controlled from above.

The talents of the *National Geographic* team and the Society's resources form an unrivalled combination which is chiefly concerned with maintaining a standard of excellence. In the photographic world, there is no other publication which devotes so much attention to photography and spares little expenditure in human skill and energy and available resources to produce images which convey the marvels of nature and the exotic mysteries of far away corners of the world.

ONE FILM ONLY

One roll of film can be burned up in a few seconds if you use a motor drive and shoot just about everything in sight. But Homer Sykes shows that with a selective eye, a single roll can go a long way
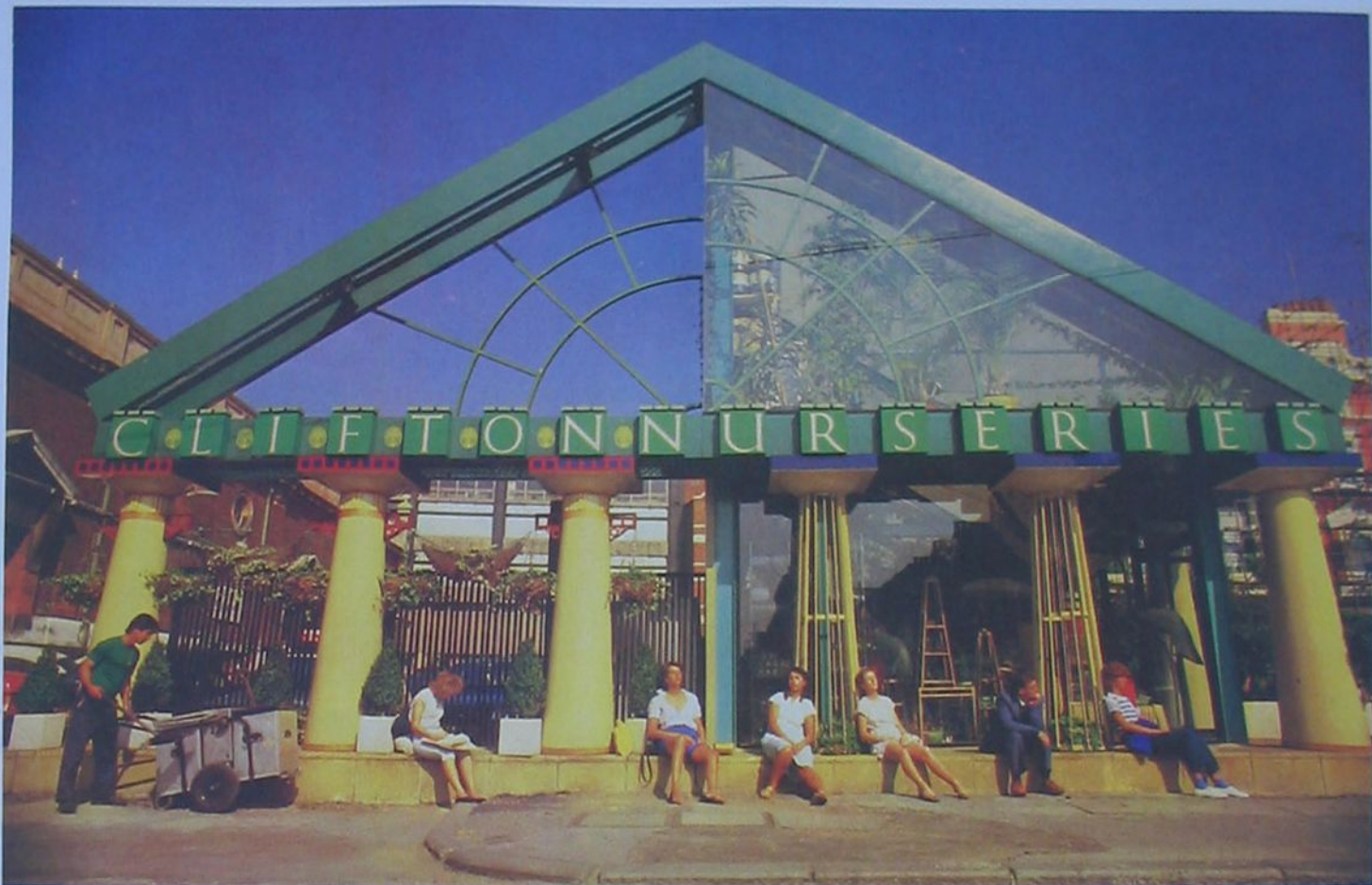
The ability of professional photographers to repeatedly produce eye catching pictures is often attributed to their tendency to use large quantities of film and so increase the chances. But how would someone accustomed to shooting 15 or 20 rolls on a short picture story manage when restricted to a single roll? Homer Sykes was intrigued with the challenge and spent an afternoon using just 36 frames to capture the atmosphere of the Piazza in London's Covent Garden.

Uncoupling the motor drive from his Nikon F2 was one of Homer's first steps—the motor could devour the whole roll in less than ten seconds. But Homer's main preparation was to work out and write down exactly what to photograph. This included the main buildings, the fruit and vegetables that used to be the livelihood of the area and the people who now visit the Piazza for entertainment—a young couple seemed
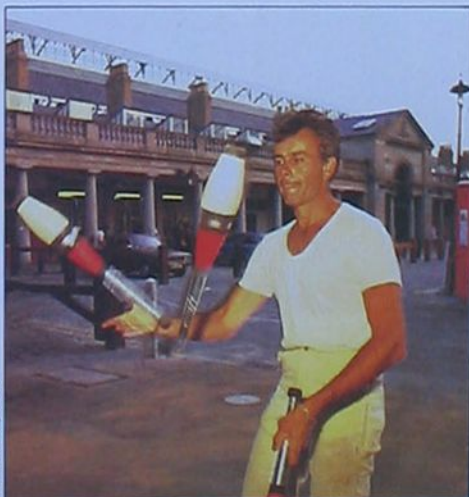
Juggler *When the light began to fade Homer used a flash gun and a gold reflector to give a warm light*

Facade *A 24 mm lens and a polarizer were used for this shot. Homer found two or three lenses were adequate*

particularly appropriate. In this way Homer made sure that he avoided missing out important details of the place—when constantly looking through the viewfinder at potential subjects it is very easy to end up thinking you have photographed certain things when in fact you have not.

In spite of all preparations, Homer did not find it an easy task to spread the afternoon's work evenly across a single roll of film. 'Initially I found that I was limiting myself too much. By being overly selective it is easy to miss good subject material altogether. I felt reluctant to take chances or deal with conditions or subjects that were not absolutely safe. At the end of the day I found myself with a few frames left over.'

Homer Sykes

An exercise like this can teach you to be more selective, but there is also another side to the story that Homer pointed out. 'Sometimes you have to waste a few frames to get some good pictures in the end. Photography is never entirely predictable and I would always want to take more shots than necessary just to allow for the unexpected or to try something different.'

Three girls Homer felt that candid shots of visitors to the piazza were essential and used his 105 mm lens to capture these girls unawares. **Dusk** Homer waited around to take a few dusk shots for further variety. He usually brackets low light shots, but with one roll he could not afford to do this. **Bench** Once again, the 105 mm lens proved ideal for candids
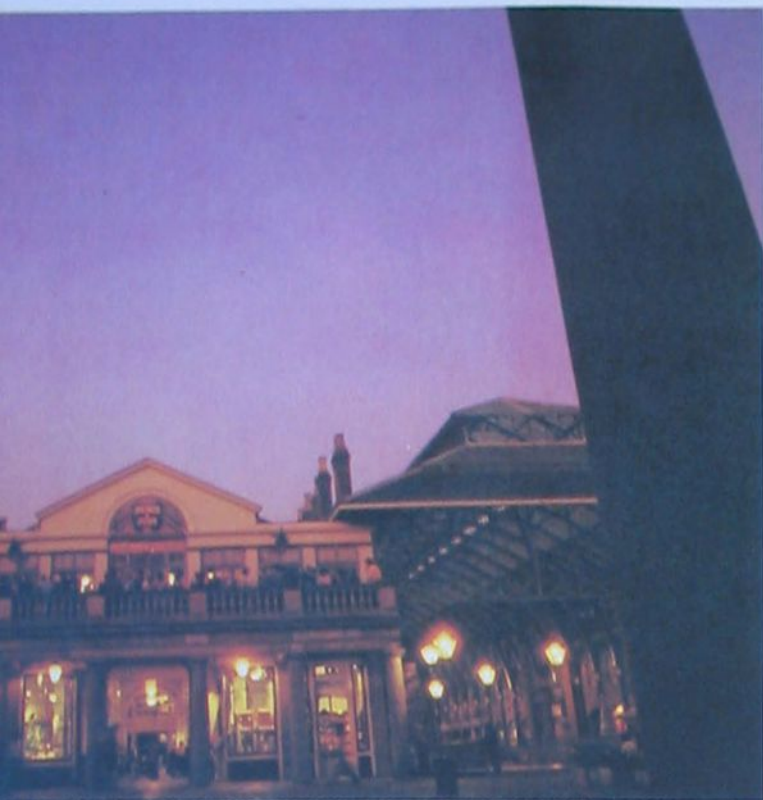
Sitting down *Homer took great care over the composition of each shot to avoid wasting film. Here he framed the image to include the grafitti above the subject.* **Fruit and vegetables** *A close-up of one of the stalls provided a reminder of what Covent Garden used to be and nicely complemented the candids*

RAPID COLOUR PRINTS

Colour printing used to be a lengthy process, but now, thanks to two radically different processes, Kodak Ektaflex and Agfachrome-Speed, colour prints can be produced quickly and simply

Until recently the processes used for colour printing were an extension of those used for black and white printing. All the popular colour processes—Ektacolor, Agfacolor, Ektachrome, Agfachrome and Cibachrome—use the familiar sequence of development followed by bleaching and fixing. But although these processes have been made as simple as possible, they are still awkward, lengthy and sensitive to errors—with the result that many enthusiasts restrict their darkroom work to black and white.

Now, however, these traditional colour processes have been supplemented by two radically different colour printing systems. Both systems use a single processing solution and each offers print quality comparable to the traditional methods but in a much more easy going way—so much so that these processes are certain to prove attractive to those who previously worked only in black and white, or who did no darkroom work at all.

The Kodak Ektaflex PCT system uses a lamination principle in which the special PCT film, once exposed and processed in activator, is brought into contact with Ektaflex paper to make the print. The film is exposed just like ordinary colour printing paper, in the same sort of conditions. Negative or reversal PCT film can be chosen at will to make prints either from colour negatives or from colour slides. The same Ektaflex paper is used in both cases. A special print-making machine is needed to 'process' and laminate the two sheets of material.

The Agfa Agfachrome-Speed system also uses a single activator solution, followed by a wash stage, but is even simpler as no lamination is involved—the processing of a sheet of exposed material can be done in a dish or drum and takes only 6½ minutes including the wash. An additional special feature of this material is that the contrast of the print can be varied by simple adjustments to the activator solution. Intended for making prints from slides, Agfachrome-Speed material is exposed through its base. The colour image is then formed by a diffusion process when the material is activated.

Setting up for Ektaflex

The heart of the Ektaflex process is the printmaker—a more or less essential item which costs rather more than a simple enlarger. Its function is both to activate the PCT film and to bring it into intimate contact—at the lamination stage—with the Ektaflex paper.

Setting up the printmaker correctly is

Ektaflex *Compact and fairly simple to use, the printmaker is an important part of the Ektaflex system*

obviously an important part of the lamination process and Kodak's instructions are very detailed in this respect. It is important for a user who is unfamiliar with the machine to follow the setting up instructions meticulously. A few dry runs—using a sheet of PCT film and Ektaflex paper—carried out in normal room lighting may seem wasteful but can give very useful practical experience of those stages that are normally carried out in complete darkness. You can also practice using normal resin-coated paper in place of both PCT film and paper—discarded prints will do.

In routine use, the setting up procedure commences with a rinse down of the printmaker, using warm water, followed by the somewhat tedious but very necessary process of drying every-

thing off—particularly the lamination rollers, cover and film loading ramp. The printmaker has to be firmly fixed to the work top—this can be done by clamping or by using special screw holes—and a good time to do this is after the cleaning operation.

It is best to decide what print size you want before filling the printmaker. You have a choice between, normally, 10 × 8 or 7 × 5 inch but you can make prints using part-sheets providing you keep to either 8 inch or 5 inch as one of the film and print dimensions. The movable edge guide which lines up the film with the Ektaflex paper just before lamination is submerged in solution and can be awk-

Using the Ektaflex printmaker

1 *Make sure the lamination rollers are clean and dry before using the printmaker*

2 *Set the tension bars into the slots behind the rollers*

3 *Pour the activator solution into the printmaker, taking care to avoid splashes*

4 *Fill the printmaker to the top of the marker in the top left corner*

5 *Close the lid, making sure that the tab on the bottom left is correctly set*

6 *With the tab in place the edge guides are now correctly aligned*

7 *Fix the ramp to the printmaker and load the paper and exposed film*

8 *Slide the paper down the ramp into the activator solution*

9 *After 20 seconds laminate the film and paper through the rollers*

Reducing the processing time

Normal *This Ektaflex print, taken from a slide, was given the normal suggested development time of 20 seconds and a lamination time of six minutes*

Under *This print was given a much shorter development time, and although there is a slight loss of contrast the effect is negligible*

ward to move—without splashing—if the print size is changed constantly.

Next, pour in the special activator solution. This is very caustic alkaline solution and every possible precaution must be taken in the handling of it. Rubber gloves and suitable goggles provide some measure of protection against splashes, but also wear a good covering of old clothes—and work on an easily cleaned surface. Have a towel and wiping cloths to hand to deal with any splashes from the printmaker.

When the printmaker is filled with activator—it takes almost all of the 2.5 litre bottle in which it is supplied—carefully close the cover, and you are ready for printmaking.

Making Ektaflex prints

One rather peculiar characteristic of Ektaflex paper is that it can be handled in normal light—and the first stage of making a print is to remove a sheet from its storage box and place it, grey side up, on the paper shelf on the cover of the printmaker. You can then proceed, in your own time, with the PCT film exposure under normal colour printing conditions—without coming to a frustrating dead-end because you have forgotten to load the printmaker.

You can use the paper in half or full sheet sizes. If you are cutting—which you can do safely in daylight—remember to allow for the fact that the Ektaflex paper must be slightly larger than the PCT film. You rarely get a perfectly registered lamination especially when using smaller sizes of paper for tests. The resulting print may have to be trimmed to a size somewhat

smaller than intended so remember to allow for this when composing the enlargement.

It is best to use a proper trimmer when cutting paper and film to get sheets perfectly rectangular. The film—which looks and feels like paper—has to be cut in darkness so arrange suitable card and tape stops on your trimmer, or make up a cutting board (see page 2315).

Each film sheet is notched on one edge and the emulsion side faces you when this notch is on the right hand side of the topmost edge. When you cut the sheet, use the unmarked part before you forget which is the emulsion side, leaving the marked half in the packet or in a paper safe until required. If you will be using the film within a short time, it will be safe enough to leave it in the box without any further covering, though Kodak warn you not to do this. If you cut but do not use the PCT film straightaway, it is a good idea to clip the appropriate corner so that you can identify the emulsion side later on.

PCT film is exposed in much the same way as normal colour print material, using the recommended starting filtration and time (see below). One important difference is that the negative or slide is loaded emulsion side upwards because the image is reversed in lamination.

As the negative or slide is printed upside down you may have trouble with Newton's rings in a carrier with glass—the anti-Newton glass will be on the wrong side. Either use a glassless carrier or swap the carrier glasses around to correct this.

The PCT film's reverse is almost black and clearly visible as such if you

inadvertently place the sheet emulsion side down on the easel. However, the sheet is not wasted—simply end the exposure, turn the sheet over and begin again.

The exposed sheet of film is then loaded on to the ramp of the printmaker and slid into the activator according to Kodak's instructions. A smooth action is needed to avoid splashing the activator which is filled very close to the top of the unit. Droplets on the ramp or activator must be wiped off before the next print is made. Use a damp cloth to do this, and thoroughly wash it afterwards. Dry the ramp before you use it again.

The PCT film remains in the activator for the recommended time—usually 20 seconds at all normal working temperatures—unless you are experimenting. This timing is not critical, however.

When the time is up, the film and print are levered jointly towards the lamination rollers which are rotated at approximately two turns a second. This action does need practising beforehand, in a dry run, to establish a suitable coordination of the left and right hand movements.

The film and paper emerge from the rollers and should be left for the approved time. This depends on the room and work top temperature, and on the type of PCT film—it is longer for reversal—but can be as low as eight minutes for normal results. Room lights can now be turned on unless you wish to run through several other prints.

After the recommended time, you can peel the two apart to reveal the print on the paper half of the sandwich. As with many forms of colour prints, do not make a final assessment of the colours until the paper is dry, when colour saturation and depth of black will have improved.

Exposure, filtration and testing

Ektaflex PCT film has very similar properties to conventional Ektacolor paper and changes in filtration produce very similar results—so there is no need to 'rethink' filter values if you are already familiar with this aspect of colour printing. Starting filtration is recommended on each pack of film and these change from batch to batch just like normal paper. The film is of similar speed also, so instead of using Kodak's suggested—and rather extensive—four stops trial prints, try giving exposure times more closely around your usual colour printing times.

For tests, you can separate the sheets sooner than recommended if you wish—just over half the normal time is enough to show the colour balance. Appropriate adjustments can then be made on a more accurate test.

After use, the activator solution is poured off, via the drain tube, for reuse. The claimed capacity is about 75 full-size prints, and the solution should last about a year. Remove the printmaker's fixings to the worktop and tilt the unit to get all of the activator out. Then wash and dry the machine.

Possible variations

The system, as befits the name Ektaflex, is flexible and allows considerable scope for variation. It is worth experimenting to find out the limits for error, but you can also use some effects to control the final result and even to create certain images which would be hard to achieve in any other way.

As mentioned, if you do not laminate for the full time you can assess the colour fairly well—the prints lack saturation but blacks are rather coloured. By reducing the developing time, however, you reduce the contrast somewhat at the cost of slightly coloured blacks and a slight shift in colour balance. These effects can be exploited to either control the contrast, particularly with a transparency, or to achieve a high key result, especially with a subject which has no dense blacks to spoil the effect. You will have to reduce the development time to as little as five seconds to achieve these effects and it may take practice to run prints through in such a short time.

Small reductions in development time will show very little effect in the finished print and this may be useful if you want to run off a batch of prints quickly. A development time of, say fifteen seconds, gives results which are virtually indistinguishable from those given the recommended time.

It is also possible to use the same negative to laminate a further print. But as there is only a limited amount of dye available in the negative film, the results are again desaturated and pastel, unless the first print was laminated for only a short time. There are difficulties with making a second print. One is that the dyes may seep out of the emulsion into the activator, discolouring it and giving a cast to all subsequent prints. The same thing can happen if you leave the film soaking in the developer for longer than the approved 20 seconds when making prints normally. When making second prints, begin the lamination process immediately so that the used negative spends as little time in the activator as possible.

Another problem is that unless you peel the first print apart in darkness, the negative will be heavily re-exposed and the second print will have a strong cast in the highlights—magenta with negative type film, and yellow with reversal type film. Kodak suggest that this effect can be used creatively, and that different colour re-exposing lights could give different results. The reversal material is slower than the negative material, so electronic flash may be necessary to achieve interesting results.

Agfachrome-Speed

Agfa's product, Agfachrome-Speed, has some similarities to Ektaflex, though it is a quite different material. It consists of one sheet instead of two and the movement of dyes from the sensitive layer to the image layer takes place by diffusion through the material, rather than by transfer from one sheet to another. Like Ektaflex there is just one caustic solution, and the transparency must be placed in the enlarger the wrong way up. But processing is even simpler: just immerse the material in the activator for 90 seconds, then transfer it to a washing bath of running water for five minutes. The print then simply needs drying. Other features of the system are the opportunity to vary the contrast of the print and, under some circumstances, processing in white light.

The secret of Agfachrome-Speed lies in the structure of the material. Below the light sensitive layers is an opaque black layer; during activation the dyes diffuse through this and through a layer of white titanium dioxide to form an image on the back of the material, in a similar way to instant picture materials. The white layer forms the background against which the image is seen, while the black layer allows the image to be viewed even as it forms, as long as the exposing side is still shielded from light.

The material is therefore exposed on the black side, unlike most others. This has the advantage that it allows you to check that you have the material in the enlarger the right way up; the black layer prevents wastage should you expose the material the wrong way up, since the emulsion itself will not have been exposed. The other consequence of the way the material is designed is that the transparency must go in the enlarger the wrong way up, with the same potential drawbacks as Ektaflex if you do not use glassless carriers.

It is possible to load the material into a holder with a dark slide, but open on one side (not suplied by Agfa). The exposure is made by pulling back the dark slide in the darkroom, then closing it and taking it into the light for processing.

Processing of Agfachrome-Speed can be done in a dish, but the lifetime of the activator will be limited as it is affected by carbon dioxide in the air. Drums or tanks will help to keep the activator fresh. The activator has a very high alkalinity, with a pH of 14, so rubber gloves and goggles are advisable.

After 90 seconds in the activator, the print can be viewed in white light. If you have a open-sided holder, you can actually watch the image appearing during this time. The print is then washed, and the colour can be assessed after another minute—though for best results you should wait until it is dry.

One great advantage of Agfachrome-Speed is that the contrast can be varied by adding either water or potassium bromide to the activator. For lower contrast, add 2 g per litre of potassium bromide, and for higher contrast add 10 per cent water.

The activator has the capacity to process one square metre of material per litre, and can be regenerated by adding 3 g per litre of potassium hydroxide. Treat this chemical with great care—it is a corrosive substance which may be subject to restricted supply. Store the pellets in an airtight container.

The process can be carried out at any temperature between 18° and 24°C, with no change in procedures.

Unlike Ektaflex, the material can be used in any size—even cut to fit a 35 mm camera for lighting tests, though it is comparatively slow and is balanced for tungsten light, so using it in this way might be impractical except under certain circumstances.

The colours produced by Agfachrome-Speed may look different from those given by other reversal materials, but may seem closer to the colours one expects in books and magazines. This is because the dyes used conform to standard specifications for printing inks, used in book and magazine production, unlike the dyes used in most other colour photographic materials.

Agfachrome-Speed

Single sheet *Unlike other materials this paper is exposed on the back*

Results *Contrast can be varied by altering the activator solution*

Dave King

Ektachrome processing

When you send a roll of Ektachrome to be processed by a professional D & P lab, the quality is entirely in their hands. But just how well do commercial labs process Ektachrome?

Kodak's E6 colour process, the process used for all modern Ektachromes, will soon become an industry-wide standard. Even Agfa-Gevaert, who long produced films which worked on a system quite different from Kodak's, have recently introduced films which can be processed in E6 chemicals. Because of the widespread popularity of Ektachrome, it is very interesting to look in detail at the film and its processing.

Ektachrome was launched by Kodak in 1946. Prior to this, Kodak's only slide film was Kodachrome, with its complex processing. Ektachrome was really a by-product of Kodacolor, which Kodak produced in order to satisfy a demand from the US Air Force. USAF wanted an air survey film that could be processed on the spot—actually in the war zone. They approached Kodak with the idea of setting up a Kodachrome processing plant on a train, but Eastman Kodak dismissed this as impractical, and instead started work on a film which itself incorporated colour couplers (see page 551), so these need not be carried in the colour developer solutions. This step, they realized, would greatly simplify processing in the field. They came up with Kodacolor, and from this developed Ektachrome.

The Ektachrome process used today is the most recent in a line of Ektachrome processes. Kodak made changes to the original processing cycle, and dubbed this E2. This was followed by E3, E4, and finally E6. With the exception of two specialist films, Photomicrography colour and Ektachrome infrared, which are both E4, all Ektachrome films and most other reversal films use E6 except in the Eastern bloc countries where they use the Agfa System.

At home, Ektachrome is normally processed in a single developing tank, and the tank is drained completely of each solution after every stage of the process. The professional labs, on the other hand, generally use 'dip and dunk' processing machines. On these, the film is loaded into racks or hangers, which are lowered into the solutions, and raised out of them. This means that the bottom end of each roll gets slightly more development than the top, but this rarely makes an appreciable difference to film density. Agitation is by bursts of nitrogen gas, which stir up the developer in a controlled manner.

The other significant differences between amateur and professional processing are largely those of scale. A lab buys and mixes chemicals in much larger packages, and replenishes solutions, rather than discarding them when they become exhausted. Most labs will also run a silver-recovery programme.

The most important practical point for the amateur when choosing a lab is consistency. For this reason, Ektachrome processing should be confined to one lab—chopping and changing will mean that you cannot be sure how dense your film may appear. Each different lab generally sticks to within about half a stop of the processing recommendations, but this means that any two labs may be as much as one stop different. If you use just one lab, you can compensate for their processing by marginally altering the film speed dial on your camera.

These variations between labs are perfectly natural, and since each individual lab usually sticks very closely to its own processing procedure, the results from any single company are generally completely consistent.

The other variations between labs is in image colour. Some labs run warmer or cooler than others. This is a function of the pH of the developer: 1 ml of a 5N concentration of sulphuric acid added to the colour developer (per litre) will reduce the yellow balance by 0.05 density units. Adding 1 ml of 5N Sodium Hydroxide solution per litre increases the yellow balance by the same amount. This control could presumably be exercised over domestic processing, too.

Clip testing and pushing or pulling (see page 1320) are valuable facilities if

Still life *All the films processed had a noticeable green cast; the one from which this frame was taken was among the least green of the batch*

you have access to them—remember that if a film is being clip tested, you should specify which end you want clipped. If you fail to do this, the lab will test the most convenient end: on 35 mm this is the leading frame, and on roll film the tail—the last frame.

The quality you obtain from a pushed or pulled film does seem to depend partly on the lab. Speed changes often result in changes in the warmth or coolness of the image, and it is possible to control this variation using pH changes but not all labs do this.

The tests

You might imagine that the best way to decide which laboratory is the most consistent would be to ask professional photographers, who are frequent and demanding users of colour processing facilities, for their recommendations. But in fact professionals differ widely in their opinions of labs, and one leading photographer, noted for quality, may use a lab which others, also in the top league, would advise you to steer very clear of.

Processing a film is rather like cooking: even the best restaurants have off days, when things are not up to standard and it only takes one poor report to give a place a bad name. There is probably no laboratory that has never damaged a film

in some way, but a good lab should have negligibly few problems. A fair test, therefore, would extend over several months. For this reason, our tests, involving single films only, just reveal the range to be found among labs, and are simply identified by letter. The test involved 10 laboratories, all in the UK. They included a leading professional laboratory in London, which uses the latest computer-controlled dip-and-dunk machine and claims to process film for some two thirds of London's professionals; a provincial lab using a roller process machine, in which the film is transported slowly through the solutions by means of rollers; a lab with a hand operated tank system; and a lab which processes every film in a spiral tank.

Each lab regularly includes a Kodak test strip among the films, which when dry is analyzed on a densitometer so that the accuracy of the process can be checked. Some labs put through one a day; some do as many as three a day. Kodak offer a monitoring service, which involves a more elaborate test strip, which may be sent to the lab packed in dry ice, and a detailed report on performance. One laboratory, highly regarded among professionals, ran this test once a week, while others never used it at all. A typical processing time was about 55 minutes, of which about 15 to 20 minutes was drying time at about 40°C—one lab gave a full half hour.

Our own tests involved photographing three different subjects under controlled studio conditions—a Macbeth Colour Checker card, a still life of fruit, and a female model. The Macbeth card has a variety of carefully selected colours, and a range of neutral density patches, which can be used to give a simple characteristic curve for the film. This will vary according to the speed and

the contrast which result. The still life had a white background, useful for showing colour casts, and for revealing certain defects such as scratches. The female model wore a white blouse, also susceptible to colour shifts, and had a fairly dark background which would show up some drying marks. In addition there were several blank frames on the film, which showed the maximum density and overall black cast.

All the exposures were made on the same day using electronic flash lighting, with a new Canon F1 camera and 100 mm lens, chosen for its reliability. The film was amateur (rather than professional) stock) Ektachrome 64, all from the same batch, with some 10 months to go before its expiry date, as typically found. These films were shot at the same time as a batch of Kodachrome 64 films, which form the basis of the next Equipment File.

The results

Ektachrome is somewhat notorious for having a blue cast, so it was a little surprising to discover that every processed film had an obvious green cast. As the Kodachromes and Ektachrome 400 films shot at the same time were all virtually neutral in tone, the cast must have been present in the Ektachrome 64 film batch.

We therefore shot another film from a different batch and source, this time within nine months of its expiry date. The colour on this was very close to neutral. Kodak say that an overall green cast is indicative of poor storage or outdated film. We bought the film in summer from a dealer with a very large turnover, and it was exposed and sent for processing within two weeks of purchase, suggesting that the dealer's storage was inadequate, although they have a refrigerated warehouse.

Typical grey *On the Macbeth card, most films gave slightly green neutral density*

Good grey *Only a few of the processed films gave a grey as neutral as this*

Poor grey *With some films, the green cast could be very severe*

Ray Duns

Flesh tones *and light backgrounds show the presence of a cast most readily; this film had only a slight cast*

A drying mark, *as in the top left hand corner (below), can ruin a picture—especially if on the emulsion side*

Robin Scagell

Credit: Laurie Lewis (left margin)

Credit: Robin Scagell (left margin)

The X-ray hazard

Are Ektachrome films susceptible to X-rays? We passed Ektachrome 64 and Ektachrome 400 through an IAL Rapiscan machine of the most modern type, as used in a number of international airports. This gives a much lower X-ray dose than earlier machines. There was no detectable change on either film, despite being passed through the machine ten times.

These results apply only to this particular type of machine, which gives a dose of 0.15 millirads per pass.

Densitometer readings
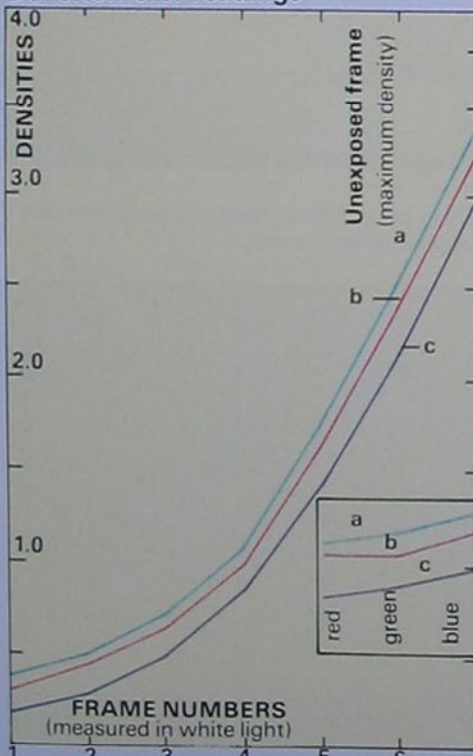
The graphs (a, b and c) show the densities of each of the six neutral tones (numbered 1 to 6) on the Macbeth card. The boxed curves are of a mid grey frame, measured in red, green and blue light

Credit: Trevor Lawrence (left margin)

Kodak claim that Ektachrome is within 10CC units of neutral when released to dealers, and that it should remain neutral within its shelf life, though it eventually goes green. Deterioration can be hastened by storage in hot conditions, or by being kept without the plastic tubs in an environment containing vapours such as formaldehyde. Kodak try to avoid releasing film with a green initial cast as this tends to be far more objectionable than magenta or blue casts.

The green cast, however, varied considerably from lab to lab. It was even possible to sort the films in order of cast, simply by looking at the intensity of the green. While most of the results were acceptable unless compared with a Kodachrome, two of the films were strongly green, giving an unpleasant cast to the model's skin in particular. The lab which processed the greenest result told us that they vary the proportions of the colour developer replenisher in order to prevent green casts, and run test strips once or twice a day which are measured on a Macbeth densitometer. The test therefore suggests that unaccountable shifts can occur despite regular control strips.

At the other end of the scale, two films have very little green cast and the results therefore appeared quite acceptable. Ironically, it would seem that had the batch of film not had an overall green colour, these two labs would have given it a magenta cast. As it was, the most

extreme result has a blue tinge.

The blank frames showed a considerable variation in colour, from deep green from the lab which sent back the film with the greenest cast, to deep reddish-brown at the other end of the scale. The mid range films had a brown tinge to the blank frames when viewed in sunlight.

No film was found to be completely free from minor abrasions and drying marks. Most drying marks were unimportant and appeared on the film side rather than the emulsion side, so they could be wiped off with care. It is not uncommon, however, to find bad drying marks on the emulsion side of Ektachrome film, often around the sprocket holes, appearing as semi-circular arcs where water has clung to the holes. Kodak recommend that laboratories use demineralized water to dilute the stabilizer, which is the final solution, especially in hard water areas. They also suggest that the initial drying temperature should be kept low. On roller processors there is a tendency to keep temperatures high as the film can only spend a comparatively short time in drying, to allow a high throughput.

One favourable point was that all the films had similar contrast and speed, indicating that the processing was consistent in this respect. The tests therefore suggest that by sticking to one lab, and if necessary using filters to allow for any consistent bias in colour, you can get very repeatable results from Ektachrome film.

JUDGING LANDSCAPES

A critical test of a photo is to compare it with others, as in a competition or magazine selection. We asked four photographers to judge some landscapes

The photographers' choice:

John Sims	A C E D B
Homer Sykes	A B D C E
Ian McKinnell	C E A B D
Colin Molyneux	A C D B E

Of the five photographs there was almost universal agreement on the first choice —Homer Sykes, John Sims and Colin Molyneux all chose A. There was also gerneral agreement on the qualities which made it stand out. All commented on the composition. Colin Molyneux, for example, said 'The road leading into the picture is a classical landscape device and is used very effectively here.' They also agreed on the pleasant effect given by the backlighting.

Ian McKinnell put photo C first, commending the composition 'with the rigid, almost mechanical grid created by the tree trunks contrasting well with the chaos of vegetation behind.'
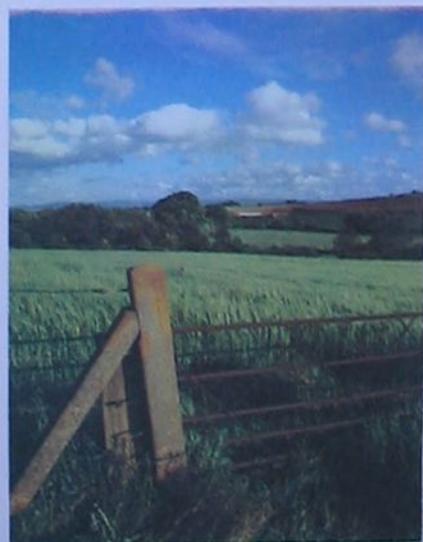
Homer Sykes placed B second, saying he thought it 'pretty but not outstanding'. He suggested that filtration would have improved the image by cutting down on the excessive blue—always a problem at high altitudes.

All of the panel felt that some of the photographs displayed certain basic technical shortcomings. C was well composed but underexposed, D was, for Ian McKinnell, 'rather a mess, with no real focal point—nothing to hold attention.'

The only real disagreement concerned E—Homer Sykes and Colin Molyneux put it last but Ian McKinnell placed it second 'simply because of its beautiful colours'. As John Sims concluded 'Taken as a group, the entries convince me that landscape photography is much more difficult than most people imagine, particularly for city dwellers'.

NIGHT WATCH

Most people only take photographs when they can see a good picture. At night you may not be able to see the scene at all—but the results can often be very rewarding

Night photography often puts people off because they fear that it is technically difficult. Yet it can offer a whole new world of creative photography. familiar landscapes can be transformed and strange effects otherwise impossible can be created with no more than the standard range of equipment. You can take spectacular colourful pictures at times when most other photographers have given up and gone home

Photography needs light, but in the absence of the sun you can use time exposures in twilight, moonlight and even starlight, as well as the whole range of artificial sources, including just during twilight the scene takes on a subtle colouring, which often records on film in unexpected ways. On a clear evening, the main natural colour is a mixture of blue, yellow and red, with blue as the overall cast. Green foliage

appears almost to glow, while high clouds appear different colours depending on how they are illuminated. The general coloration can be hard to capture on film, but is worth the effort

Most people photograph the bright western sky, often aimed for silhouettes and while this is a ready source of photographic material, you should also try pointing your camera the other way and look for scenes that will work on a

French Alps *Photographs taken after dusk tend to have an overall blue cast. By including a sprinkling of yellow lights you can suggest cosy domesticity*

Navaho Lake, New Mexico *At sunset the Eastern sky provides a rich backdrop as the dying sun casts a golden glow on the landscape*

graphic basis—features of the landscape, buildings or statues can contrast with deep, saturated colours. Red roofs can appear very prominent, particularly if you use 81 series filters to remove some of the blue cast.

On overcast days the dominant colour at twilight will be a greyer, colder blue which is impossible to filter out. This can be exploited to contrast with tungsten artificial lighting, which will appear yellow. These colours work very well when creating a mood, and suggest a wintry exterior and warm, cosy interior —even at other times of year. Similar colours appear when photographing tungsten lights reflected in wet roads at twilight—even though there is little colour visible to the eye.

When the last of the twilight has died away, genuine night photography can begin. Nights are not all uniformly black—indeed, only when there is no moon and the sky is completely overcast and you are far from built-up areas can you literally not see your hand in front of your face. In most developed areas streetlights cast a glow on the clouds which will record in exposures of a minute or so even on slow film. But the brightest form of night illumination away from the cities, which have their own characteristics (see pages 136 to 141), is moonlight. You can use moonlight in a number of ways. With a bright winter moon, for example, you can take a
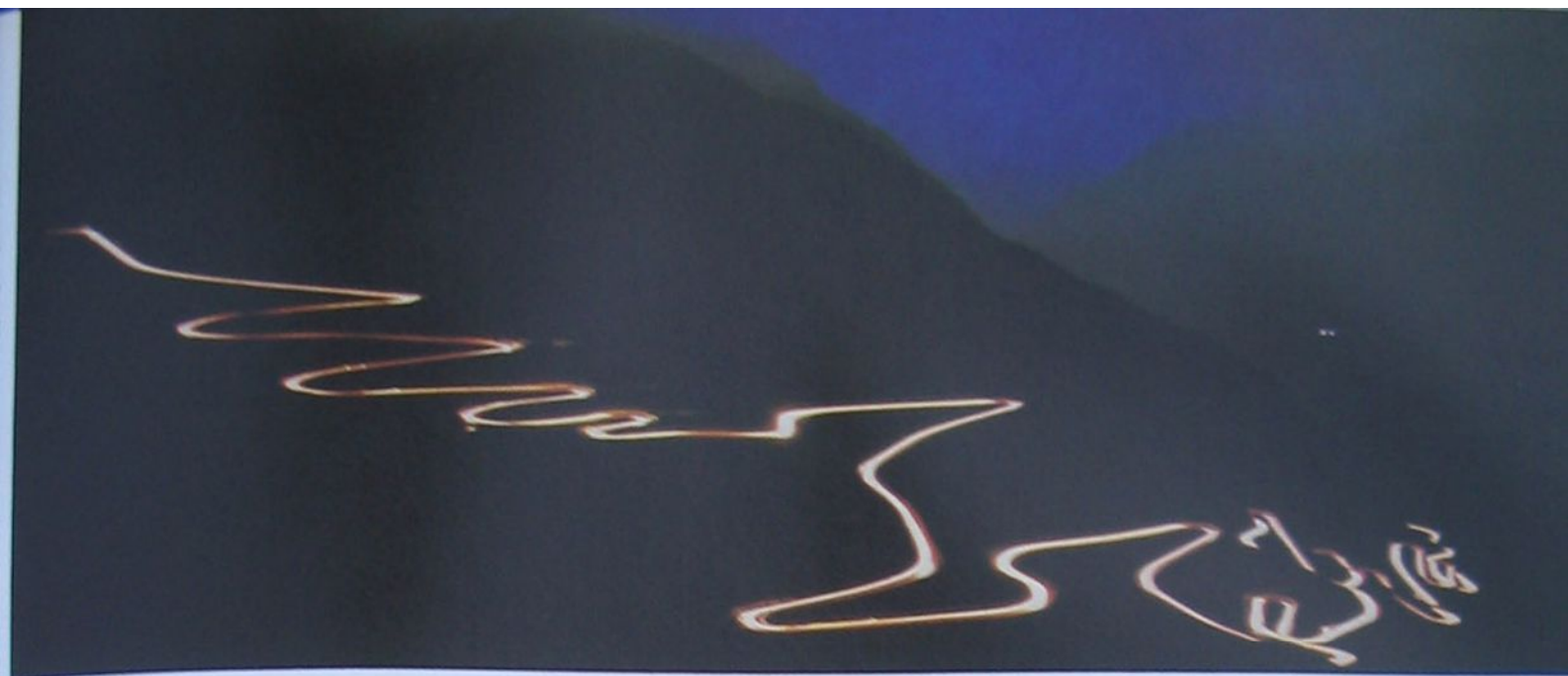
photograph which actually looks similar to one taken in daytime conditions.

Because of the structure of our eyes we are unable to distinguish colours in very low light levels and instead see everything in a more or less dim monochrome. The light from the moon is, however, merely reflected sunlight, comparatively weak but otherwise unchanged. However, if you take a moonlit landscape with a long enough exposure the colours will not be quite as we expect them due to reciprocity characteristics of the film and this can give strange effects.

Another way to use the moon as a light source is to make deliberately weird photographs by giving very long exposures of an hour or more, perhaps with the lens stopped down. In this time the reciprocity effects of the film will alter colours to a fairly significant degree and, more important, the moon will move across the sky. This will give a more or less natural picture but one in which 'something is very odd'—most people will not notice that objects have shadows on both sides but although they cannot 'put their finger' on the reason, they will see the landscape as appearing unnatural. It is necessary to keep any bright light sources out of the frame during such long exposures—otherwise these sections of film will burn out and may spread flare to other parts of the picture (though this may add to the unnatural appearance).

When taking these photos for surreal effect it is a good idea to build them around some element which is already somehow alien in itself, a misshapen rock, a lightning-blasted tree or an abandoned car for example.

Long exposures will have interesting and only partly predictable effects on anything in the frame which is moving. Try photographing on the beach, for example, and the rocks will stand out solid and dark while the waves dissolve into a kind of low mist. Alternatively, a house or fence in a field of waving corn will stand out in a blurred landscape—receding fields and roads are particu-

St Gotthard Pass, Switzerland *On a dark night the shutter can be left open for long periods to capture moving lights as attractive trails*

Cusco, Peru *Bright lights and coloured objects stand out with a special clarity and richness against the velvet-black night sky*

David Parker

Graeme Harris

Graeme Harris
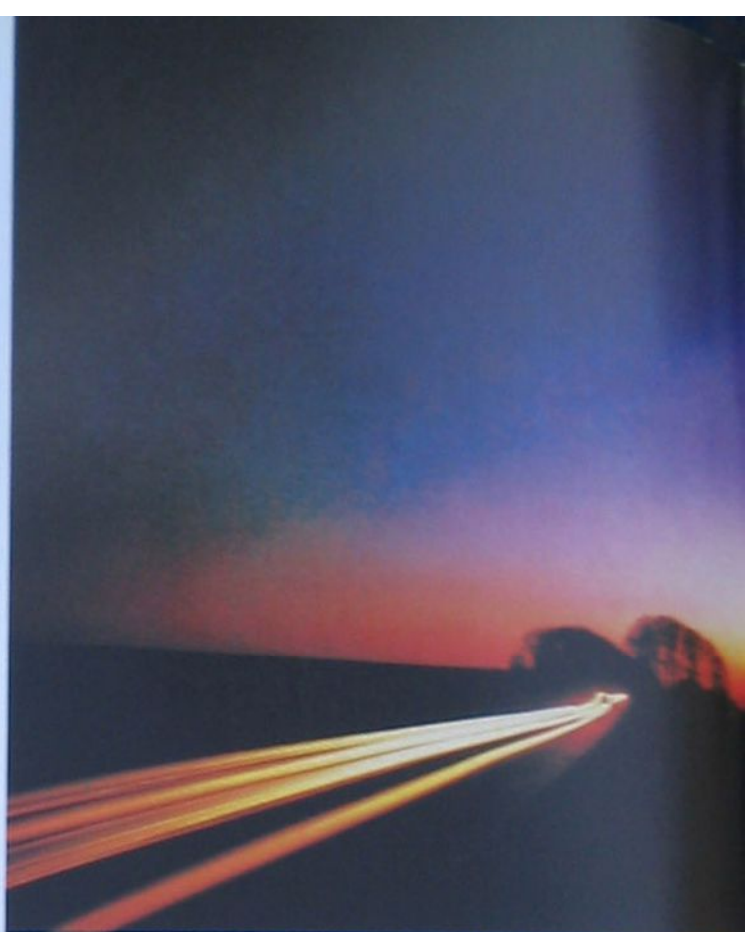
Trees *Artificial light has strange and only partly predictable effects. Mercury vapour lamps, for example, give foliage a weird green glow*
Twilight glow *The light changes quickly at dusk, giving a spread of glowing colours. Including the trail of headlights adds impact*
House *A misty night gives a restricted range of delicate colours. A single highlight creates a focal point*

larly effective in this unsettling kind of shot. Take a photograph of a tree and the trunk will stand out proud and solid while the branches will get progressively more blurred towards the ends, where waving twigs form a kind of halo around the tree.

It is often a good idea to work out compositions for this kind of photograph during the day, returning to a pre-arranged spot at night. During the day it is easier to find and remember strange objects and to find satisfying compositions.

If you want to take moonlit landscapes which look as we expect moonlit landscapes to look, you will have to use the blue filter beloved of movie-makers. This will cut out the colours and register the scene closer to the monochrome effect as seen by the naked eye. Not surprisingly, a fairly good night time effect can be achieved by shooting during the day, combining strong blue filtration with a degree of under-exposure. Night time should really be used to take deliberately strange photographs, as this is when it really comes into its own.

The moon itself makes an attractive element in a night time composition but it is generally best to use a double

exposure rather than take a straight shot of a scene containing the moon. One reason is that the moon will be so much brighter than the general scene that if you use a long enough exposure to get detail in the landscape the moon will burn out. Indeed it may move in the course of the exposure if it is longer than a couple of seconds. By using a double exposure you can put a correctly exposed moon anywhere you like in the overall composition.

If there is no moon at all you can consider yourself lucky! It is now up to you to find or produce the light for your photograph and whereas with a moon the existence of elements such as a horizon

which should generally be kept horizontal imposes limitations on you, a completely black night is like a blank canvas which you can cover with images limited only by your imagination.

Street lamps make good light sources and can either be used merely as a source of illumination or as a part of the composition. Mercury vapour lamps appear bluish-white to the human eye, but come out green on colour films. Rather than try to filter this effect out, which cannot be done, use its strangeness to advantage. Take portraits by it for a deathly skin tone and strange shadows. Alternatively, photographing vegetation can give dramatic results as

Phillip Hayson./Colorific

John Sims

Bruce Bennett/Tony Stone Picture Library

Cotton picking *When using artificial light sources, you should ensure that the illuminated areas form an interesting or powerful composition*
Chew Valley Lake, Somerset *A small aperture gives good sharpness from foreground to infinity but means that a heavy tripod is essential*

leaves and grass will take on unearthly 'day-glo' colours, glowing with a strange life of their own.

Photographing houses from outside at night you can, perhaps with the cooperation of the inhabitants, make a photo with two or more images in one, a different scene in each window. When doors are opened, light will flood out to illuminate a small part of the landscape and people or animals such as cats can be photographed in silhouette against the light. These house lights will generally provide an attractive warm tone which reinforces the feeling of comfortable domesticity in a dark and forbidding landscape.

On a dark night you, can compose photographs by opening the shutter for long periods and illuminating selected parts of the scene with flashes from a portable gun, using as many flashes as you like and either keeping out of the picture altogether, or perhaps photographing yourself several times in different places, lit from different angles. Isolated exposures on a frame can work well but it is generally best to prearrange the photograph and mould the many exposures into some coherent composition.

You can also use this multiple-image technique to distort normal proportions, perhaps photographing a house on a small section of the frame with a wide angle lens and then filling the rest of the frame with a massive tree, photographed with a telephoto. Previsualization will be necessary to achieve good results and a large format camera such as a twin lens reflex or even a 5 × 4 allows you to compose more precisely, placing your subjects in areas previously drawn out on the ground glass screen with a felt pen.

With the freedom offered by a pitch black night you can decide your own colour scheme to suit the subject matter. Use a combination of flash and street lights, take multiple flash exposures with different coloured filters over the flash, use a powerful torch to illuminate sections of the subject or to paint an abstract design. These kinds of photographs are easier if there is no light at all in the sky but they are still possible if there is a dim level of overall light, if you have a friend or helper to cover the lens with a cap of a black card between each exposure on the frame.

Even stars provide some light and although they are too weak to illuminate a scene they can be photographed in themselves. Given a sufficiently long exposure they will leave long arcs of light as the earth rotates and although this is not particularly interesting in itself, you can add variety by using them to surround a tree or a building such as a church steeple.

2621

SHOOTING TO SELL

Making money from your pictures may be easier than you think. By taking extra care over technique and choice of subjects you can turn your holiday snapshots into the type of pictures used in brochures, calendars and many other places

Most amateurs take photographs purely for the pleasure of producing interesting or attractive pictures. But few realize that given a sufficient level of competence and a knowledge of what is required, these same pictures could earn money as well.

At the very least, the income from the pictures can help to offset the cost of your hobby. And if you can supply enough good pictures the earnings can be quite substantial. But you need to know what to shoot, how to shoot it, and how to go about selling the final pictures.

A reason for shooting

It is best to think about where you are going to sell the pictures when you are shooting. So it is worth looking first at possible markets. You can try to sell the pictures yourself to magazines, calendar companies and so on. But a far easier method is to put your shots into a picture library who then sell the pictures for you, taking a percentage of the fee.

The main advantage with libraries is that you have to do relatively little work. Once you have sent the pictures, the library does everything. Trying to sell pictures yourself is very time consuming, assuming that you know where to sell them. Picture libraries know of markets which may not have occurred to you, and they are constantly being approached by magazines, publishers and advertising agencies for specific shots. So although most libraries take about 50 per cent of the fee, they can sell more pictures more often, and this more than compensates.

There are many libraries throughout the world, some general and some specializing in just one or two subjects such as sport, natural history or science. Telephone numbers and addresses for the UK and Europe can be found in specialist publications such as *The Creative Handbook* and the *Picture Researcher's Handbook*.

Before sending any shots to a library, ring them or write to them explaining what sort of work you have and asking if they have any specific requirements. Some of them, especially the larger libraries, demand that you send at least 200 to 400 pictures as a start, and then contribute on a regular basis. However, some accept smaller amounts. In any

case it is often a good idea to send a representative selection of your work—say 20 pictures—to give them an idea of the sort of work you have. However many you send as an initial selection, you

Colosseum trails *By waiting until evening, the photographer could use a long exposure, so that the distracting people and cars recorded as blurs*
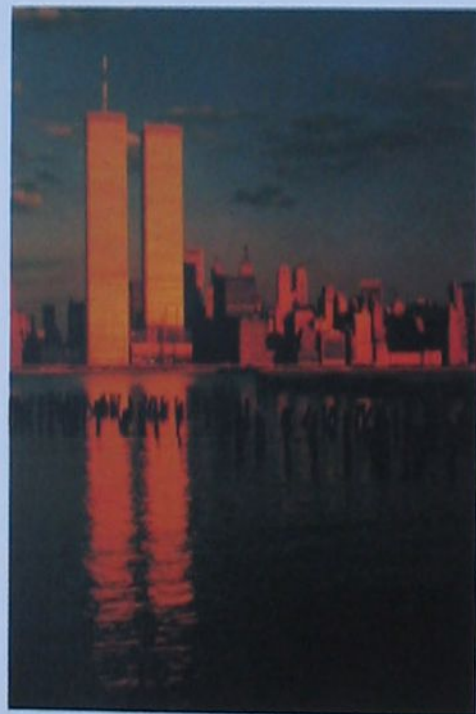
Up and across *Shooting a scene both vertically and horizontally allows potential clients to pick the format to suit their requirements. Leaving spaces in the shots may allow text to be dropped in, which also increases saleability*

Craig Aurness/Susan Griggs Agency

should always try to build up as large a collection of pictures as possible in the library. Most libraries carry a very large number of pictures, so if you only contribute a few the chances of your shots being selected are relatively slim.

Picture libraries are mostly interested in colour transparencies, though some do accept black and white work, particularly those specializing in reportage and newspaper features. Pictures should always be of first class quality and carry full labelling relating to
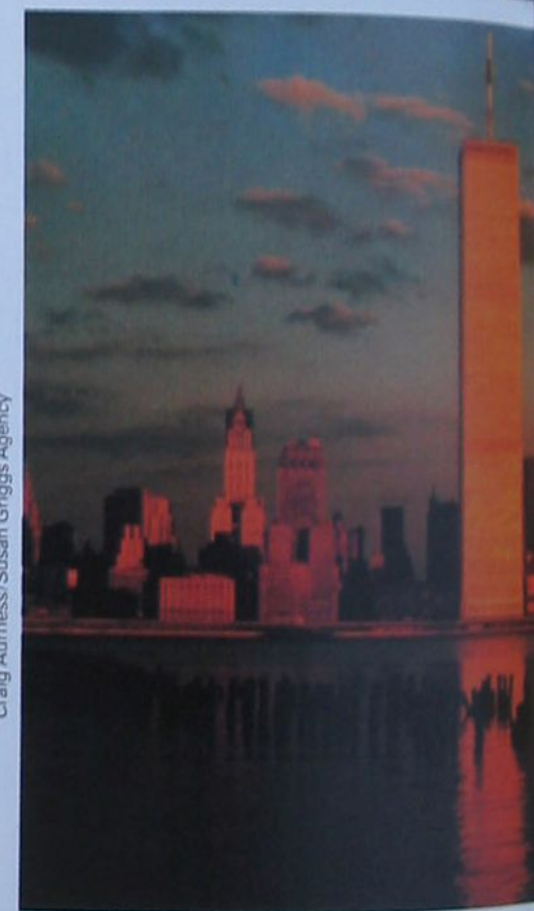
time, place and any relevant technical details. With natural history photographs, for example, caption details should include the latin name for the animal or plant. Each transparency should also be marked with your name. This can be written on the mount (which should be card) with a pen, but a much more professional appearance is given if you use a specially made rubber stamp.

A professional approach is important in all areas of picture selling. If, in the selection you send to a library, there are

J. Alex Langley/Aspect Picture Library

Roger Werths/Susan Griggs Agency

John de Visser

shots with less than perfect exposure, processing faults or other faults, they will think that you are unprofessional and so will be reluctant to use you, even if your other pictures are quite reasonable.

Do not be disheartened if a library rejects your pictures. In addition to any specialization, most libraries have preferences for certain types of picture, and acceptance or rejection can depend on the personal tastes of the person looking at your work. So it is worth trying several different places. Once your shots are accepted, however, they may be tied up for three or more years, so do not send in shots to which you need access.

Selling yourself

If you do not have enough pictures for a library, or prefer not to let the pictures out of your hands, you can always try selling the shots directly. The most likely market for the amateur is the travel industry. There is a constant demand for new pictures for use in magazines, brochures, leaflets, books and guides. So

Volcano cloud *Events of national or world importance, such as the eruption of Mount St Helens, are very worthwhile subjects. Even after the shots have lost their news value they will still be in demand for articles, books and so on, both on Mount St Helens and other related subjects*

Happy families *The subject matter does not have to be as dramatic as an exploding volcano. Shots of archetypal people and families also sell well*

2623

Jerry Young
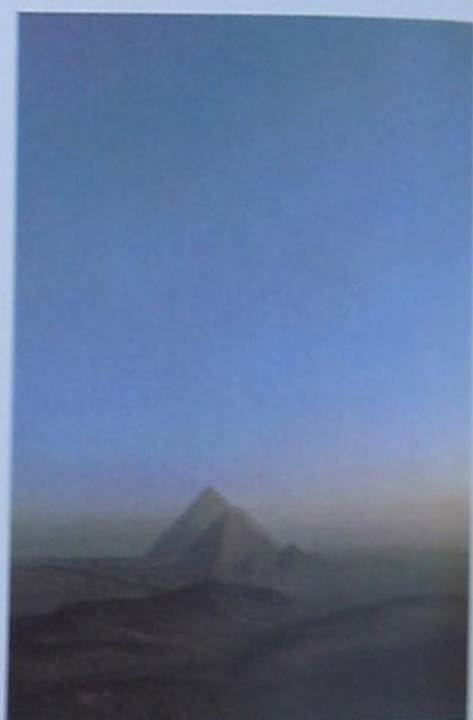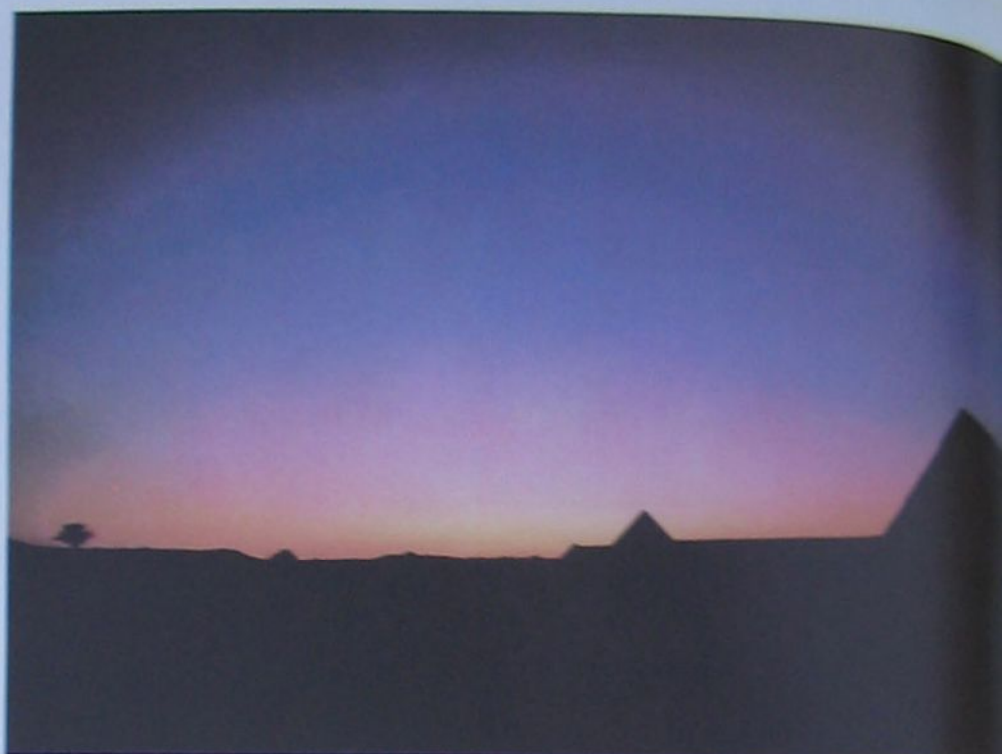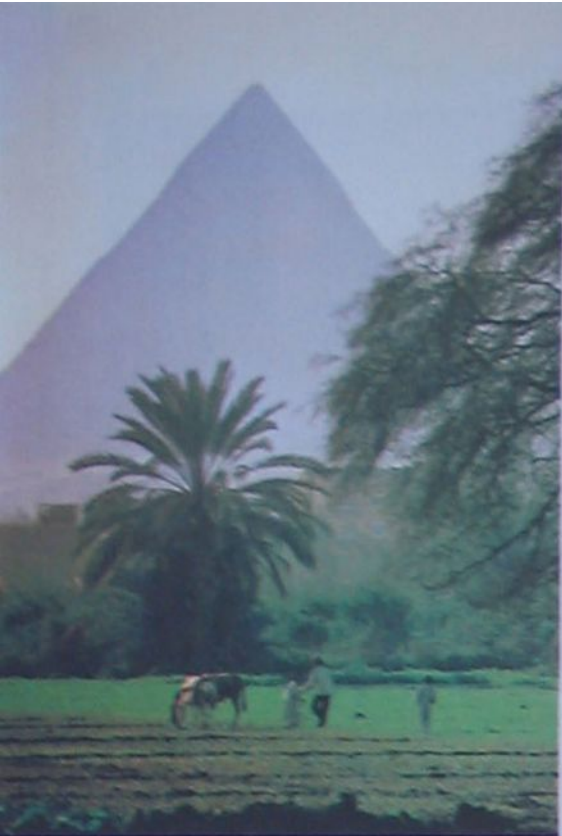
Pyramid selling *Once you have found a suitable subject you should make sure that you get the most out of it. By shooting it a number of different ways, from a variety of viewpoints, at various times of the day, you will end up with a set of photographs that can be used for a whole range of different purposes*

the first step is to take a look at the type of publications around, and the type of pictures which they use. Possible clients include tour operators who print their own brochures, national and local tourist boards.

When approaching these people try sending a letter with a sample photograph—a professionally printed enprint is sufficient. However, any pictures you submit for possible publication should be on colour transparency film, as this is preferred for reproduction.

If you have a large number (500 to 600) of stock pictures, it may be worth approaching book publishers, especially those specializing in books on photography. Other possible markets are: photographic magazines; specialist and trade magazines; calendar and postcard companies. Most of these accept 35 mm originals, although some calendar and postcard publishers demand larger formats—at least 6 × 6 cm.

Shooting the shots
Once you have sorted out possible markets you can take pictures with these in mind. Quite often saleable pictures can be taken while you are on holiday. But it is necessary to spend a little extra time and effort on the photography. It may be necessary to wait until the right moment—when the geyser erupts, or some ceremony occurs, for example. In extreme cases you might even have to choose the right time of year. You will frequently find that, although the subject may be right, the weather or the lighting is not. This means coming back again on a different day, or at a different time of day—or night.

These things may seem obvious, but when you are shooting it is easy to miss some small detail which could improve the picture and so improve its chances of selling. For example, many postcards show a general (often dull) view, frequently shot around midday. The result is a record shot of the scene, which is rarely interesting as a picture. By wait

ing for better light (say at sunset) and shooting a detail such as a famous landmark, the picture can still show the location but can also portray the mood of the place. At the very least, the shot will be more interesting to look at. This sort of thing is easy to overlook on a busy holiday.

With very famous locations or objects, such as the Eiffel Tower, finding a different way to photograph it can be difficult. However, even if your shots are not greatly different to existing ones, such subjects are still worth photographing as there is always a demand for pictures of them.

To get good pictures, which are more than just snapshots, requires a little planning. You need to be in the right place at the right time. So it is a good idea to get maps and guide books some time before you go. Check on times of sunsets and sunrises. Just before you go, and while you are there, check weather reports, and also the local press for details of any seasonal or unusual occurances or events.

Another valuable piece of research is to look at the postcards on sale. These vary from very good to awful, but at least they will give you a good idea of local attractions and viewpoints, which you can use as a starting point. The photographers who took the postcard pictures usually know the area well, and have had plenty of time to find the best locations. This means that they have done much of the hard work for you. Using the postcards as a basic guide you can then try to come up with something different, and hopefully better.

Do not be tempted to shoot too much. Take your time and aim for quality rather than quantity. Look carefully at what is included in each shot. Litter, ugly signs, manhole covers and so on can ruin a shot and are often difficult to spot when you are peering through the viewfinder. Try to use some other object to disguise any unwanted bits (it is remarkable how useful a bunch of flowers can be!). If you are taking pictures on holiday, it is quite likely that there will be other tourists around, and this can be a nuisance as they tend to clutter up the scene. Also, if you are trying to sell the pictures to a tourist board, they will not want to show the area crowded with people, even though that is what they are trying to achieve. So shoot at times when there are fewer people or cars around, such as early morning.

Another point about cars is that the licence plates, in some countries, can date the picture. This is also true of car types, fashionable clothes and shop windows. For some uses a picture which looks slightly dated may not be a problem. But generally it is best to make the picture as timeless as possible, since this extends its useful life.

Travel pictures are often used quite small, so simple, graphic shots work best. They have more impact than wide shots with lots of fussy detail in them. If the scene demands a wide angle lens, then make sure that there is some foreground interest to give some depth to the picture. Framing a scene using an archway or tree branches may sound corny, but it works.

If you are shooting on a rectangular format such as 35 mm it is worth shooting both vertical and horizontal versions of the same picture. Quite often magazines and books need to fill a particular space, and if your shot is the wrong shape they will not use it. It is also a good idea to shoot three or four identical frames of a picture which you think might have sales potential. Transparencies often get damaged, either in processing (see pages 2625 to 2629) or in handling. It is much easier to make copies in the camera than to have duplicates made later.

Exposure needs to be very precise. But if in doubt make the transparencies a little on the dark side—say one third of a stop underexposed. Plate makers can always take some of the density out, but they cannot put in detail which is not there. Always bracket exposures if you are unsure.

Seasoned wood *In addition to shooting one subject from a range of viewpoints, you can try shooting at different times of the year. Remember to take previous shots with you when you go to reshoot, so that you can get exactly the same composition and viewpoint. Shots like this sell again and again, as singles, pairs or a complete set*

John Sims
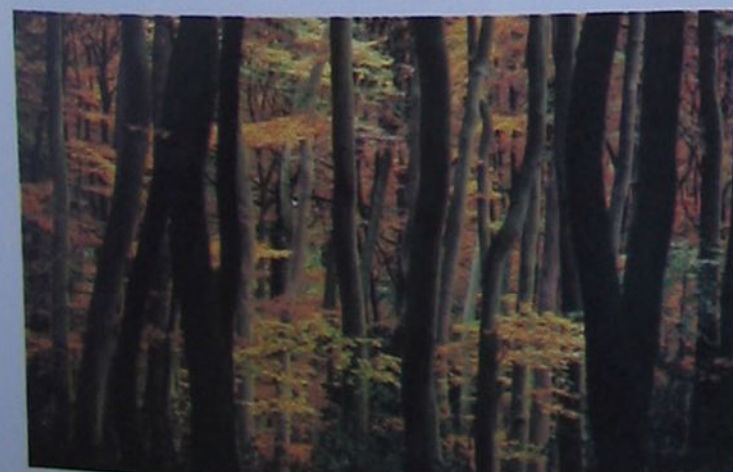
KODACHROME PROCESSING

Kodachrome, unlike Ektachrome, cannot be processed at home, due to the complex nature of the cycle. So, once exposed, the results of your photography are out of your hands, and can sometimes be unpredictable

Most photographers would agree that it is hard to find a colour film which gives better colour reproduction and resolution than Kodachrome. Its reputation has remained virtually unchallenged since it was first introduced and because of this it is interesting to see just how well it stands up to critical study—particularly as for many photographers, both amateur and professional, it is as vital a piece of equipment as a camera.

Kodachrome was introduced in April 1935 as a 16 mm movie film, beating its nearest rival, Agfacolour, by over a year. It was the first integral tripack (see page 550)—in other words the first colour film of the type we are now used to using, with three colour layers—and was an instant success. Because of this, great pressure was put on the photographic industry to make colour available to everyone, and just over a year later in September 1936 still Kodachrome was introduced.

Compared to a roll of black and white film, still Kodachrome was relatively cheap when it first appeared, especially as the price included Kodak's processing of the film. It was returned from processing in an uncut strip, and it was not until February 1938 that the now-familiar card mounts were introduced. These 2 × 2 inch slide mounts very quickly became an industry standard.

Kodachrome soon became an important part of the Kodak industry. Indeed, its popularity has even led to a suggestion that Kodak had an unfair advantage over other firms since it is often hard to find an independent processing laboratory for Kodachrome. Their monopoly of the processing facilities in Britain was investigated by the Monopolies Commission in the 1960s. They acknowledged that the process was very complex, and did not object to the monopoly. Kodak offered assistance to any lab wishing to operate the very expensive processing machinery, two of which took up the option. Both of these soon found that the work was very exacting, and dropped out. In the US, however, it is a legal requirement that Kodachrome be sold non process-paid, and there are a number of independent laboratories.

Background

Kodachrome differs from all other colour films currently available because it uses a system in which the colour couplers are incorporated into the processing solutions, not in the film itself. All other colour films use couplers built into the film's emulsions (see page 551).

This system has a number of advan-

Colour casts *These three Kodachromes show how processing can differ throughout the world. The example at the top shows neutral colours, while the example on the left, processed in Denmark, has a distinctly magenta cast. The one on the right, however, was processed in Japan and shows a green cast*

tages and also some disadvantages. From the user's point of view, the greatest advantage is the film's sharpness and freedom from grain. In terms of RMS granularity (an objective measure of how grainy a film is), Kodachrome 64 gives a reading of 10, while Ektachrome 64 gives a reading of 12. The lower the number the less the grain. This is largely explained by the fact that the bulkiness of the colour couplers incorporated in Ektachrome film make the emulsion thicker, and, generally, thin film equals good resolution.

The other advantage of Kodachrome is its permanence. On the basis of accelerated ageing tests carried out by Kodak, Kodachrome will last over 100 years in dark storage (20°C, 40 per cent relative humidity) before fading becomes noticeable. Ektachrome, on

the other hand, will last up to 50 years, and Vericolor II for only two to five years. The permanence of Kodachrome is of great value to many professionals, whose pictures are their livelihood. They cannot risk their work losing its colour, as their stock of images is, in effect, their pension which will earn them money in the future.

One of the disadvantages of Kodachrome is that in most countries only Kodak process the film, although some independent labs, notably in the US, can and do process Kodachrome. The other disadvantage is that Kodachrome is only available in 35 mm, 110 and 126 'amateur' formats (see page 1040). This is a result of the way in which Kodachrome is processed: spliced together into long rolls and then fed continuously through the solutions. At one time sheet film Kodachrome was available, known as

One stop under *normal processing gives an overall blue cast*

One stop over *normal gives a stronger green cast*

Two stops over *normal gives a stronger green cast*

Kodachrome professional. It came in sheets up to 11 × 14 inch, but was withdrawn in 1946 when Ektachrome was introduced.

Kodachrome's 'amateur' tag is less easily explained. Kodachrome is used extensively by professionals, but despite suggestions that Kodak should introduce a professional version it is still only available in 'amateur' versions. This could be due to the changes in quality control that would have to be made in manufacture and processing and also to the likelihood that as Ektachrome's characteristics are developed and improved, Kodachrome could eventually be phased out. There are suggestions, however, that a 200 ASA (ISO) Kodachrome may one day become available.

Processing
Early Kodachrome had an immensely complex cycle which involved the diffusion of a viscous bleach solution through the emulsion layer. The film had to be washed and dried three times in the course of processing, and not surprisingly, there were numerous problems, with processed films sometimes coming out blue, magenta or green.

The new processing cycle was introduced in 1938 and was much more stable than the early cycle. Development was simplified considerably by replacing the bleach diffusion with selective re-exposure to coloured light. Small changes were also made during the 1960s to make the film more ecologically acceptable, but otherwise the process remains virtually unchanged to this day.

The first step of the process is black and white development. The bottom, red sensitive, layer is then exposed to red light through the back of the film and immersed in a colour developer containing a cyan-forming coupler, which forms a cyan image in the bottom layer. Next, the top, blue sensitive, layer is exposed to blue light, this time through the front of the film. The yellow filter layer protects the middle layer from this exposure. The film is then immersed in a developer containing a yellow-forming coupler.

The middle layer is then developed in a solution containing a magenta-forming coupler and also a fogging agent, which makes a re-exposure step unnecessary. The film is then bleached, fixed, washed and finally dried. The whole process, besides drying, takes about 21 minutes.

Increasing or decreasing the speed of

Kodachrome is possible, but the three development stages make it very complex compared to pushing or pulling Ektachrome. As a result, Kodak labs will not push films, and only a few independent labs in the US will.

Problems with Kodachrome
Perhaps it is because photographers have such a high regard for the sharpness and colour rendering of Kodachrome that they are very quick to notice any faults in processing or manufacture. Those who use nothing but Kodachrome are bound to complain at every fault, even though they may find the results of other films even worse. There are, however, a few faults which are characteristic of the film.

A major source of complaint is blue spots. These are actually cyan, and appear to be pinholes in the emulsion's upper layers. There are a variety of processing faults which can account for these and for the wider blue streaks which sometimes occur. Magenta patches and dark streaks are also found from time to time.

One fault which is less easily attributable to Kodak is the pressure mark. In pale areas you may find pale grey
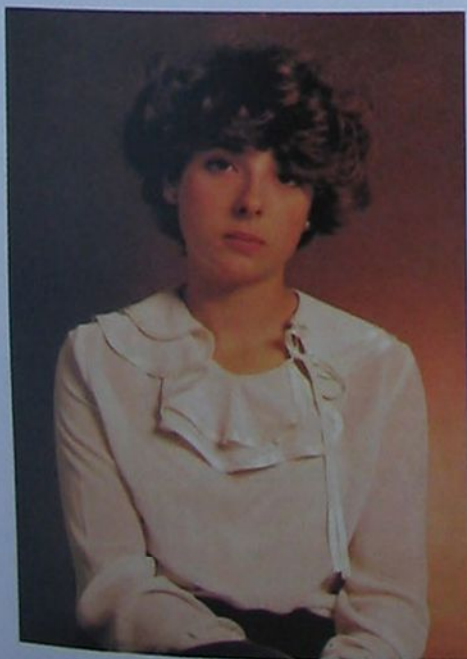
Normal *This film was exposed before the recommended expiry date*
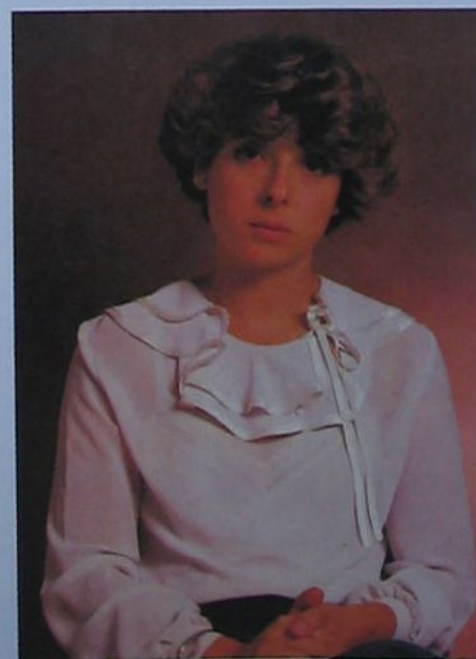
Six years old *Even in refrigerated storage outdated film shows a red cast*

Three years old *Kept at room temperature the effect is more noticeable*

streaks across the film. Kodak say these are caused by pressure on the film, and blame the photographer for winding on too agressively, or for rewinding the film the wrong way round in the cassette. Practised photographers prefer to blame Kodak, particularly if the fault only occurs on one film.

If you examine the film side of a processed Kodachrome you may notice that it has a burnished appearance, with fine streaks visible if you catch a reflection off the surface. This is a result of the removal of the black backing during processing, but only rarely are these scuffing marks objectionable.

As a result of these defects, many photographers will try to take more than one frame of each shot, with no change of camera settings, in case one is spoiled by defects. Kodak will respond sympathetically to courteous letters pointing out the faults, and if you return a pratically badly damaged film they will usually replace it—though neither they nor any other manufacturer or laboratory will enter into negotiations as to how much compensation they might pay for any shot that was damaged.

It is very important to Kodak if you can return the film end bearing the identification number stamped through. This tells them when the film was processed, and may help track down a fault.

You will, however, receive little sympathy from Kodak if you complain of damage to frames at the beginning or

Streaks *can sometimes occur in Kodachrome processing. In this case they are visible at the edge of the film*
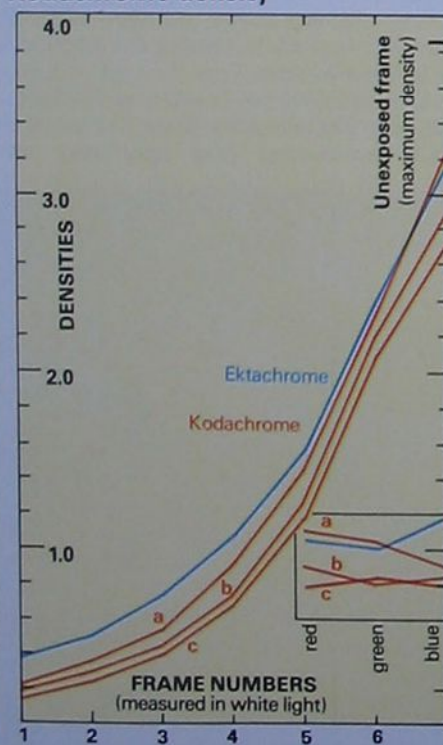
end of the film. These are used for splicing on to other films and you cannot expect them to be kept clean. Most people find that they get between 37 and 39 frames from a 36 exposure roll, but there is no guarantee that the end frames will be clean. Kodak even warn that you may damage your camera if you try to wind on at the end of a film, and the least that can happen is that the film may tear away from the spool, leaving you with a camera full of film that can only be unloaded on to a reloadable cassette.

It is true to say that Kodachrome processing, like any other, can go through bad patches. If, therefore, you have a large amount of film to process, it is best to send it off in several batches, separated by a few days.

Even with Kodak's own laboratories there are various ways of sending the film for processing. Some Kodachrome is sold process paid, and some process unpaid. The film itself is identified on the edge markings, and the mailers given with process paid film are simply used to make life easier for you and for Kodak. If you lose one, you can still send the film off, but there will inevitably be an additional delay as the film is handled separately.

Most people send their films by post to their nearest processing plant, and receive them back by post. Photographic dealers within a reasonable van drive of the plant may offer a pick up service, using Kodak's own delivery van,

and the films may either be returned to you by post or by collection from the dealer. The latter method can be much quicker than normal, and has the advantage that the postal services are not involved. You should not put your address on the mailer if you want the film to go back to the shop, but put your name on as a precaution. Kodak do not charge the dealers, but dealers may make a small handling charge.

You may also hand your film in at the plant itself, and either have it returned to you or held for collection by special arrangement. There is also an urgent service, with restricted availability. If you attempt to get Kodak to process your film urgently, you will probably be told that their fastest service is reserved for 'police and fire services'—though how many police and fire services insist on using Kodachrome rather than Ektachrome, which can be processed virtually anywhere, is uncertain. Even professional photographers have been told that they cannot have their material processed quickly because if they were a professional they would be using Ektachrome!

Using Kodachrome

Like all amateur colour films, a roll of Kodachrome is expected to change its characteristics as it ages on the shelf before exposure and processing. Factory-fresh film actually has a greenish cast, which ages through neutral to magenta by its expiry date. None of these casts should be more than 10 CC units from neutral. This does mean, however, that a new film and an

Kodachrome density

This graph shows the densities of Kodachromes processed in a—Canada, b—Australia and c—South Africa, compared to an average Ektachrome
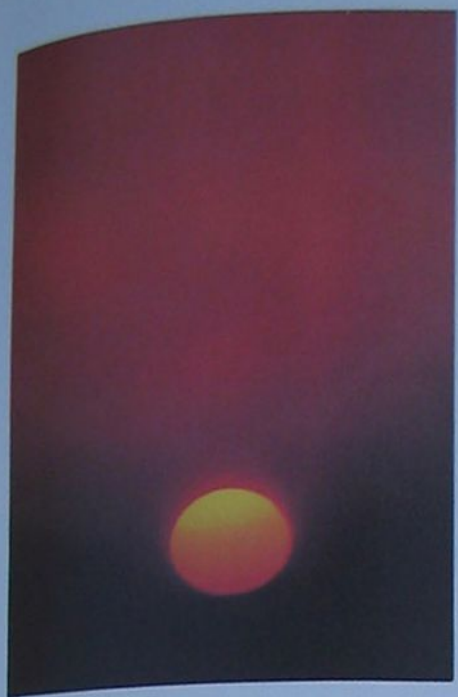
Sunspot *A fairly common complaint with Kodachromes is that they sometimes show blue spots after processing*

Skyscraper *Blue streaks such as this may occur during processing but Kodak are unable to offer an explanation*

Halo *Occasional faults, such as the chemical streaks in this Kodachrome, can ruin an otherwise good shot*

old film may give noticeably different colour renderings if compared directly.

Professionals who require known characteristics from colour films overcome this shift by testing one roll from a batch and, if they are happy, buying a large number of rolls from that batch. They can then either keep the batch refrigerated to maintain its characteristics, using colour correction filters to make it precisely neutral, or they can allow it to age at room temperature, testing one roll every so often, and freezing it when it gives a neutral result.

If you do, however, buy outdated film—often sold at half price—there is a good chance that you can correct for the magenta cast by using a light green filter. This means using the same filter on every lens, which can be awkward.

Tests

We purchased a batch of Kodachrome 64, and exposed it identically to the Ektachrome 64 discussed on pages 2614 to 2616. In addition, we exposed some outdated films that were 6 years, 4 years and 3 years beyond their expiry date.

The films were sent to a selection of Kodak's own processing labs around the world, to check whether there was a noticeable difference between them. From time to time there are reports that one lab or another gives the best processing. In addition, we sent a film to an independent laboratory in New York, for normal processing, while others were sent for processing at one stop under and one and two stops over normal processing to the same laboratory.

Only one lab failed to return the film sent to them for processing. Of those returned from 12 countries, no two were alike, but the results were mostly acceptable. The most serious fault was an overall cast. Most films showed

various strengths of green or magenta, and one was distinctly blue. Only a few were truly neutral in colour, including that from an independent processing house. Three labs returned films with severe magenta and two labs returned films with green casts.

The outdated films had magenta casts —the strongest was the one that was three years beyond the expiry date. But the casts on those that were four and six years beyond expiry were only slightly stronger than on the worst unexpired films. The reason for this is that the older films had been kept in refrigerated storage, unlike the three year old, which
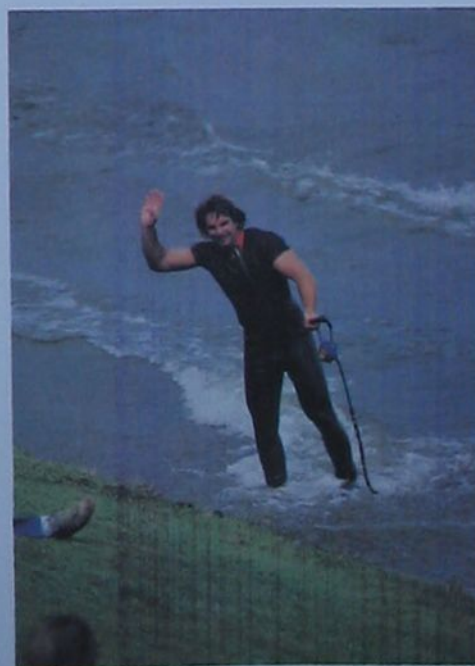
Streaks *Faults such as the magenta streaks in this shot are unpredictable and apparently unexplainable*

was stored in a cupboard at room temperature. Refrigeration is therefore strongly recommended, but if you use outdated film, you should expect a magenta cast.

Processing at one stop below normal gives a blue cast, whereas one stop above and two stops above give successively stronger green casts. For normal purposes, the results are unacceptable, but if you merely want a record of the image, and have little regard for the rendition, then the process could be useful for rescuing badly exposed film.

There were only a few blemishes on the Kodachrome slides. The most serious were a 5 mm scratch at the centre of a frame, and several blobs of dye at the edges of another. Only one frame showed blue spots.

Comparing the characteristic curves drawn from the Color Checker patches, it was evident that the Kodachrome 64 was lower in contrast and slightly slower—by up to half a stop—than the Ektachrome 64 tested on pages 2614 to 2616. These differences may not, however, be repeated in other batches of Kodachrome or Ektachrome.

Overall, however, the Kodachrome showed greater consistency of colour than the Ektachrome 64. As with that test, it is not fair to draw conclusions from only one film processed at each laboratory and it is likely that any extremes are purely temporary since Kodak try to keep the process identical the world over. Even so, as with Ektachrome, it is probably best to stick with one laboratory and, if possible, one batch of film if you are to get the most from your film. If you know what results to expect from a particular laboratory and batch of film then you can correct accordingly to get consistent results.

Orientations

Tim Page's assignment, self-imposed and open-ended, is to record the spirit of South East Asia on film. To succeed, he feels, he must go through a process of 'reorientation'—learning to live the life before trying to record it

On most assignments, the professional photographer operates under very specific restraints which force him to work in a particular way. He has to produce a set of photographs to fill a more or less definite place in a publication within a given period. With the aid of an established reputation and a sympathetic publisher, however, a photographer has much greater freedom in deciding what to do and how to do it.

Tim Page has taken advantage of this freedom to work on an unlimited assignment in South East Asia, returning again and again in an attempt to record a way of life.

To capture something as abstract and intangible as a way of life, it is impossible to use a conventional photographic approach—taking technically good records in a professionally detached manner. Instead, Tim believes, it is necessary to go and absorb the strange environment—you must 'feel' Laos before you can photograph it. This approach explains why Tim often spends as long simply living in a place as trying to photograph it. It also explains why he returns so frequently, 'The more you go to a place, the closer you get'.

Water seller *Religious merit is won by adding gold leaf or paint to a Buddha in the temple. Young boys raise money for the gold by selling water to crowds at religious festivals.*
Robes *Monks' robes drying on a rail make a simple composition in saffron*

Tim's ambivalent attitude to the tools of the trade is indicated by the vast array of equipment he both uses and regularly writes off or 'trashes'. He travels with up to seven Nikon bodies, a selection of

Monks *The incongruity of umbrellas and robes is captured in this simple and muted double portrait of semi-shod Laotian monks*
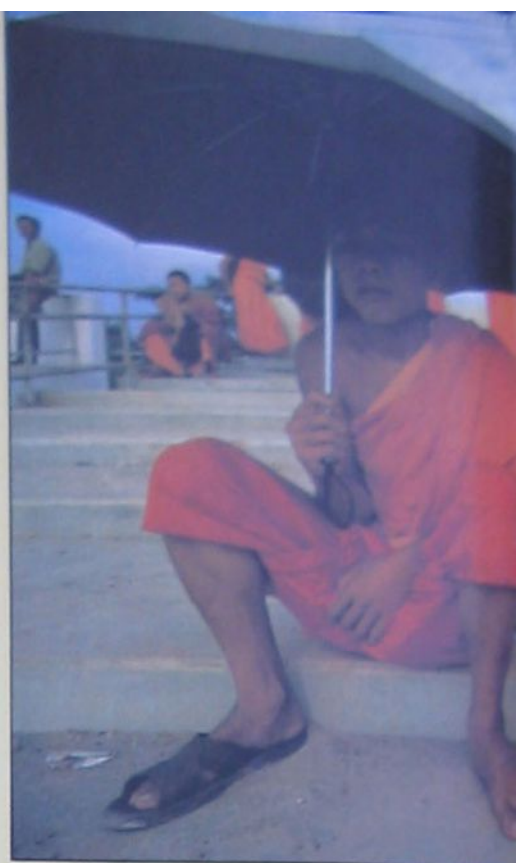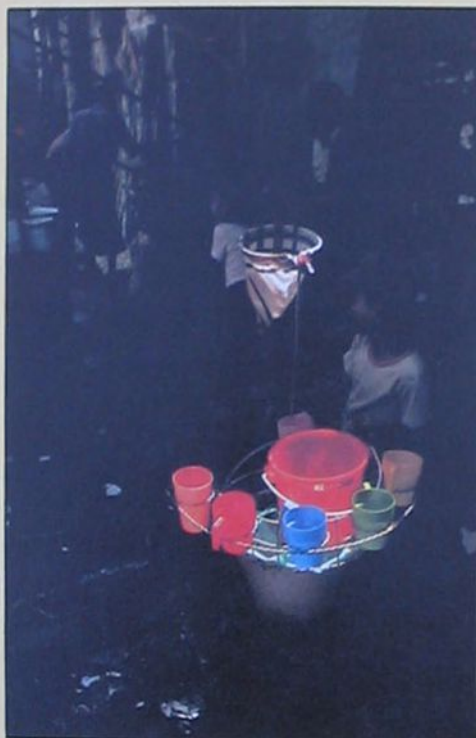
Opium *Deliberate underexposure conveys the gloom of the backstreet opium dens where elderly Laotians smoke away an emaciated half-life*

lenses from 18 mm to 600 mm and an old Leica slung permanently round his neck. In early days, the Leica was almost a trademark and, as Tim explains, 'now I feel naked without it'.

While always working in colour, Tim

avoids glossy images. He is a great admirer of the muted and delicate tones of Ernst Haas's work, saying of places in *Himalayan Pilgrimage* and *Creation* 'this is how colours really look. Understatement and subtlety is something of a rarity in a world weaned on glamour and quick excitement but it testifies to a new spirit in photography—one in which the photography is an extension of the spirit.

Buddhas *Families eat, drink and talk in front of their Buddha at the wat (temple).* **Woman** *A soldier of the Laotian People's Democratic Army at the 5th anniversary of independence*

PRESENTING YOUR PRINTS

Good presentation, whether for display or storage purposes, will not only give your prints that added sparkle, but may also protect them from long-term damage

All pictures by Tim Stephens

If it is poorly presented, even the most striking creative photograph will lose all its impact. Indeed, proper presentation is, in a way, as much a part of the photographic process as framing up and pressing the shutter.

There are almost as many ways of presenting photographs as there are photographs, each suited to a different purpose. If you are making prints for an exhibition, for instance, simple mounting is ideal. If you want to add a touch of class to your home, a stylish canvas mount set in a frame might be ideal. For a print to go in a portfolio, plastic coating should keep it looking at its best through constant handling. You can even embed photos in acrylic to make key fobs and ornaments. The range of possibilities is endless, and here we can only show a few of the more popular and useful methods of presentation.

Mounting

One aspect of most forms of presentation—particularly exhibition work—is mounting. Prints are usually mounted on cardboard using wet, dry or spray methods (see pages 740 to 743). The mounted print can then be backed with chipboard or a similar material to give a 'block mounted' picture—or framed in the traditional ways.

Top quality prints processed and to be stored to archival standards must be mounted on suitable acid-free board. Cheap types of paper—even if faced with quality paper for looks—can absorb airborn acidic particles which can attack the image of the photograph in time. You can buy special mounting board, often called 'museum board', from specialist photo dealers and some artists suppliers. Or look for material, about 2 mm thick, made from muslin clippings or cotton fibres which contains no alum, resin size or animal glue. But almost any form of board can, of course, be used for photographs which are to have a limited useful life.

One of the most impressive ways of showing off a collection of work is a portfolio box. These are made from acid-free board which is lined inside and out for both appearance and protection. Ready-made, these cost about the same as a box of 100 sheets of black and white printing paper in whatever size you require. If you are reasonably skilled at handcrafts, there is no reason why you should not make one yourself, providing you use the right materials. A box of about 50 mm interior depth should be sufficient for up to about 20 window matted prints. If you make your own, allow finger room so you can extract the mounted prints easily.

Showpiece When presenting your prints it is important to choose a method suited to your individual requirements.
Framing and glazing (1), flush framing (2) and block mounting (8) are ideal for presenting prints of any size for display in exhibitions or at home, while the plastic cube (4), resin moulding (5) and the peg block frame (6) are best suited to smaller prints for home display.

For storage or for portfolio presentation a simple window mat (3) may be sufficient, but pressure sealed lamination (9) or heat sealed lamination (11) will provide better protection.
For special presentation effects some prints may benefit from distortion glazing (7) or canvas mounting (10), which gives a textured effect similar to that of a painting

The same boxes may be used for ordinary prints but use interleaving sheets to protect against scuffing and scratching. *Archival conservation paper* can provide the ultimate protection but ordinary acid-free tissue paper is rather cheaper.

Flap storage envelopes of acid-free paper provide protection for prints stored for archival purposes but are unsuitable for those handled frequently.

Protection in plastic

One of the most effective and professional ways of protecting individual photographs—or, for that matter, any flat artwork or printed material—is to seal them within plastic. This is called *lamination* and there are two methods, using pressure sensitive or

heatseal film. Both methods provide complete protection from damp, grease and fumes—as well as sticky fingers and spilt coffee—so they are ideal for photographs used as part of a portfolio (see pages 2306 to 2309).

Heatseal film is a thin unbreakable plastic sheet coated on one side with dry adhesive. This is cut to size and laid over (and possibly under) the original after retouching, mounting and other after work has been completed. The film and photograph are then sandwiched in a special heat press until the plastic is bonded to the surface of the photograph. The lamination temperature is in the region of 85° to 90°C, applied for about two minutes—so heatsealing cannot be done without access to a proper dry mounting press. Matt, textured and

Pressure sealed lamination

Size up the roll of laminate with the print, allowing for a slight excess
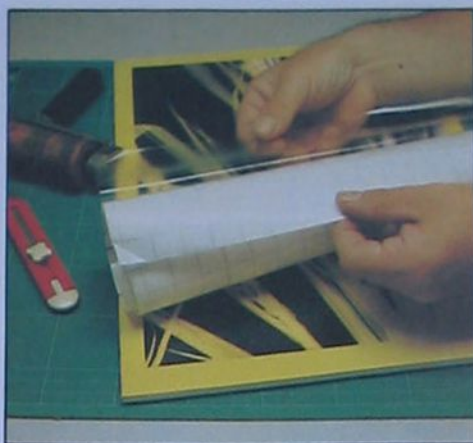
To avoid air bubbles apply the laminate inch by inch from one end

Use a sharp modelling knife to trim off excess laminate

Block mounting on polystyrene

Blocks such as this are self-adhesive and covered with a backing paper on one side

Make sure the print is laid down flat on to the polystyrene block
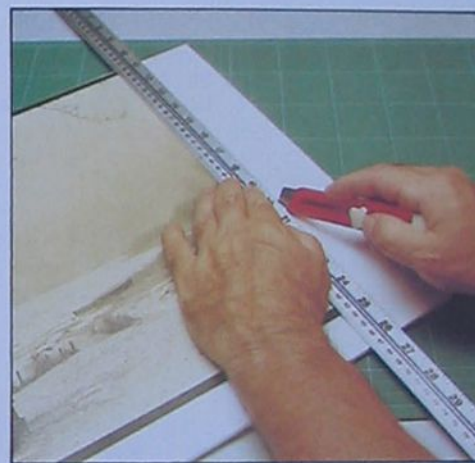
Use a metal straight edge and a modelling knife to trim off excess

glossy forms of the material are available.

Pressure sensitive PVC and polyester film can be applied without special equipment and is therefore a more practical proposition for the average amateur. The material is thin and not very strong by itself but it provides a plastic coating that protects the print well. It can be used only with mounted prints.

To use this type of film, cut a piece from the supply roll rather larger than the mounted print. After cleaning off the print and mount surface—use a perfectly dry, lint free and antistatic cloth—peel off sufficient backing paper to tack the leading edge of the film to the table.

Butt the mount into the 'V' formed by the table and the underside of the film, carefully lifting the backing paper in order not to expose too much of the sticky side which is by now dangerously close to the mount.

When you are sure the mount and film are correctly aligned, smooth down the

Resin mould

Embedding a print or transparency in resin allows a wide scope for novel ideas. String can also be embedded into the mould to hang up the result

film in a direction at right angles and away from the 'hinge' where the film sticks to the table. Do this carefully in order not to trap air bubbles or stretch the film. When the film has 'taken' along the edge of the mount, pull at the free edge of the backing paper to expose a little more of the adhesive side and rub this down as before. Continue in this sequence until the print and mount have been covered. Finally, use a fresh scalpel blade to trim the film right to the edge of the mount.

If you have a suitable mangle, you may find that this can be pressed into service. Adjust the roller pressure so that the mount thickness just passes through. Smooth the film into contact with the mount edge, as before, then cut the film free of the table. Feed the starting edge into the rollers, ensuring that the backing paper keeps the film and mount apart right up to the point where the 'nip' takes place. Carefully edge the print and mount through the rollers, withdrawing the backing paper as you do so.

Canvas mounting

Canvas mounting is a variation of the heatseal process which gives an authentic canvas look to a mounted print. The technique can be used only with RC prints and involves sandwiching special heatseal film and the print, together, under heat and pressure between, on top, overlay foil and, beneath, silicone release paper and a carrier board. After bonding, the heatsealed RC emulsion is stripped from its backing and subsequently drymounted on canvas.

Very full instructions are given with the product (Ademco) and you can get your prints mounted in this way by specialist photo processing labs if you feel dry mounting skills are beyond you.

Embedded photographs

If the idea of mounting photographs in plastic appeals to you, consider sandwiching a picture between thick, inflexible sheets—and even blocks of acrylic. Acrylic sheets and blocks can be bonded together almost invisibly—and certainly permanently—using special solvents. Really novel ways of showing off your work can be produced in this way. A variation is to embed photographs in lumps of acrylic to produce key fobs and freestanding displays as decorative ornaments. If the photograph is to be backlit, you can use opaline printing material or make transparencies and mount these against opalized acrylic. Acrylic bedding kits can be obtained from hobby and craft shops, but you can try glaziers or plastics specialists for acrylic sheet, blocks, tubes and solvent adhesives.

Patterned sheet acrylic can be used, in appropriate circumstances, in place of plain plastic or glass to cover a mounted print. Not all pictures benefit from the optical distortions created, but this is something you can experiment with—many firms provide a range of samples. But certain patterns do transform an image into a 'living' abstract whose exact characteristics may change according to the print viewing distance and angle, among other things.

Framed prints

Having your favourite photos professionally framed and glazed can be costly—so if your carpentry and craft skills are up to it, you may be able to do it yourself. If you have little experience of handcraft, it would be better to buy a frame kit—some require only the insertion of a suitable mounted photograph.

Decide before you begin work whether the print is to be glazed, laminated or left unprotected. If you choose glazing, remember that a picture framed and glazed is heavy and needs care in hanging. Condensation can form behind the glass if your frame is not properly sealed.

The finished size of your frame depends upon the size of print and overmat or mount area you select. As a rough guide for a portrait print, make the depth of the top border to the photo-

Flush framing
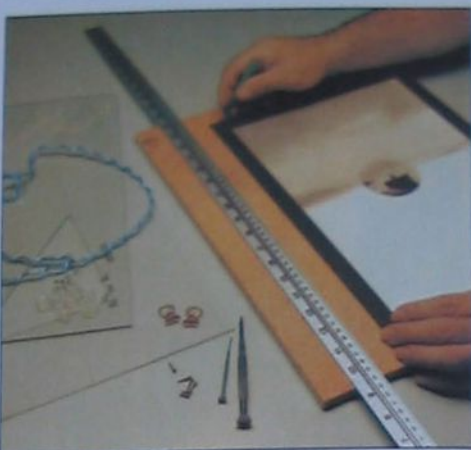
Trim the wooden block mount to the same size as the print

Secure block, print and glass by screwing clips into edge of frame

Making a window mat
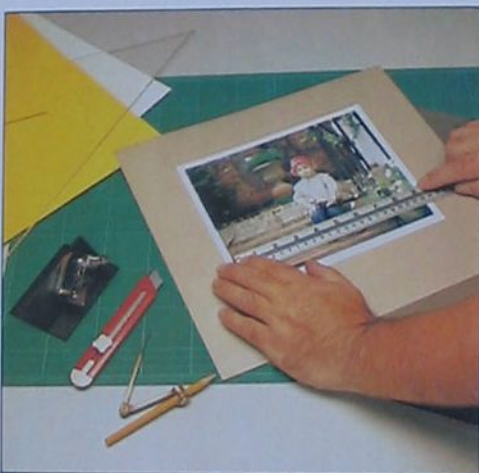
Mark the position of the window lightly in pencil, allowing for a slight overlap

Cutting at an angle away from you will give a bevelled edge to the window

Glass distortion frame
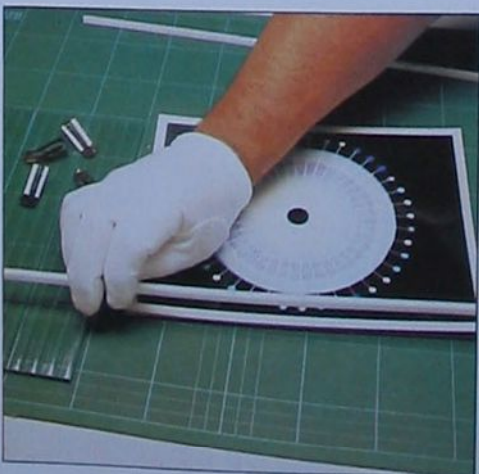
Abstracts can often benefit from being glazed with ribbed or textured acrylic. The acrylic can be attached to the border of the mounted print
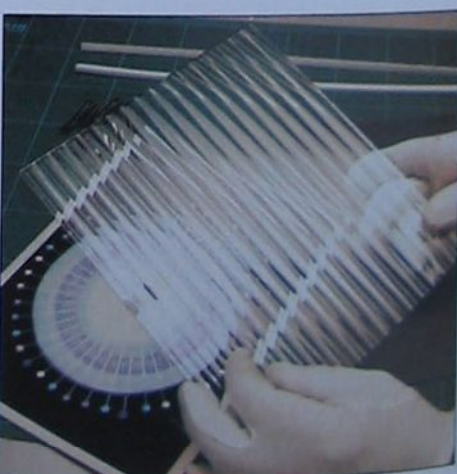
Most firms can supply you with samples of various textures, and by setting these against your print you can decide which will give you the best result

Plastic peg-block frame

Simple frames such as these are ideal for mounting small prints
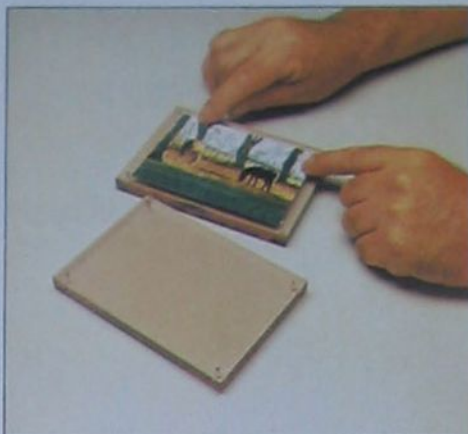
If you wish to remove the print the two halves of the frame are easily separated

Framing and glazing

Choosing a suitable mat is important when framing and glazing a print
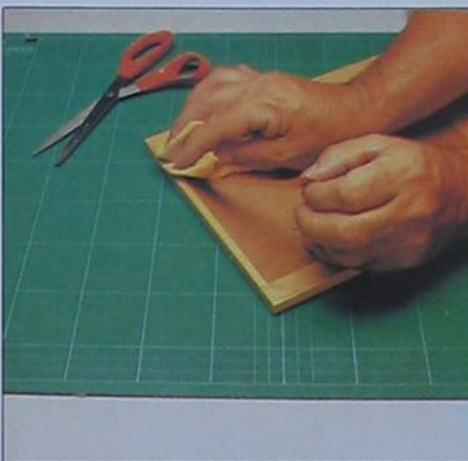
Tape the back of the frame to give added protection against dust and moisture

graph equal to half the width of the print. The two side borders can measure the same, but try and increase the bottom border by up to half again. For example, with a print width of 200 mm the top and side borders can be 100 mm and the bottom border 120 mm to 150 mm. From this you can calculate the overmat size.

The colour and texture of the mat is as important as size, shape and its area relative to your print area. You should also consider whether to add 'coach-work' lines around the print to define its border. Dry transfer rules can be used to good effect here.

You can use two methods to cut out the aperture in the overmat, one using a knife—the other using a commercial mat cutter. To give your print a professional finish you can set the cutter to make bevelled cuts.

Interesting surrounds can be made by using more than one mat. Using two colours of the same board thickness is called a double mat—the underlying mat is cut to fit the print while the top mat has

a larger aperture for 'framing' the mat and print beneath. A variation is to make the underlying mat of paper. To be even more elaborate, you can use three cards and make a triple mat. Oval, heart or diamond shaped mats can also be used to very good effect.

Constructing a frame

The type of moulding you select for your frame depends upon the harmony or contrast you desire between the frame, print and also the type of mat which has been used. The frame is very much a personal choice. There are few basic rules but avoid over embellishment. A simple frame in no way detracts from the picture. Different styles of mould are available commercially in wood, plastic or metal. When estimating the length of mould you need, add extra for mitres and allow for trim. It is better to estimate generously than to be short.

The outside edge of the overmat must slip loosely into the rebate of your constructed frame, so cut your moulding

lengths with this in mind. Use a mitre jig to get perfect 45° cuts.

Gluing and pinning requires the same care as cutting. Lay the four lengths of frame on a flat surface and in the correct order with the front surface upwards. Fit each corner with a mitre clamp. Check all is square. Remove two clamps and one length applying suitable adhesive— PVA wood glue for example—to each corner. Replace the moulding and clamps, glue, and repeat with each length until the frame is complete. Dampen a piece of cloth with water or meths—depending on the type of adhesive—and wipe excess glue from mitres and rebates before it dries. At the same time, mix up any sawdust with a spot or two of PVA and use this as a filler for mitre cuts which do not mate perfectly. Or use a suitable wood coloured filler.

Where you have used glass in the frame, pin each corner for extra strength. Panel pins must be long enough to cross the mitre joint. Drill two pilot holes at each of the top and bottom corners on the outside edges using drill bits having a smaller diameter than the pins. The hole should pass through the first half mitre and just into the second. Tap each pin gently into the wood taking care not to split it. Countersink the pin heads just below the wood surface and fill with filler matched to the same wood colour. Finish your frame by smooth sandpapering then wax, paint or varnish it when completely dry.

Your print can be mounted directly on to card or just tacked on to a backing card using corner mounts to position the print centrally. Use card of the same size as your mat and stick them together with strips of double sided tape to sandwich the print. For backing, use a piece of hardboard cut slightly larger than the mat and mount so it makes a tight fit within the frame.

Carefully dust your mat sandwich, taking care not to mark it with your fingers. If glass is used, wipe the inside surface with meths and polish it clean. Dust and clean the frame and also the hardboard backing sheet. Then lay your frame face down on to a flat surface. Fit the glass into the frame followed by the mat sandwich and the hardboard sheet. Lay a short length panel pin halfway down one length of the inside of your frame. Apply a slight pressure to the hardboard then press the pin into the wood using gentle blows of a tack hammer. The pin head should stick out from the wood approximately 3 or 4 mm. Repeat this on the opposite, top and bottom of the frame to secure the hardboard. Add extra pins where you think necessary.

Finally, cut four lengths of gumstrip using the frame as a measure. Cut a 'V' shape at each corner to give you a neat finish. Moisten one strip with water then lay it along the frame back, sealing the pin heads and hardboard edge. Repeat with the other three strips. This gives an effective dust and moisture seal around the back of the frame.

Everyone knows about the use of X-ray photography in medicine. But it is also vital in industry, reveals the secrets of old paintings and archaeology and opens up many areas previously impenetrable to the human eye

In 1895, a physicist called Röntgen, experimenting with an electric discharge tube, found that he could produce a shadow graph of the bones of his hand by placing it between the tube and a fluorescing screen. Because of the mysteriousness of the process he named the strange radiation 'X-rays'. The name stuck and the process developed into *radiography* — photography by means of X-rays—which has become more important to the modern world than Röntgen could ever have imagined.

X-rays, like light, are a form of electromagnetic radiation (see pages 198 to 199). But their wavelengths are much shorter than visible light, extending from 0.00001 mm to as short as 0.0000001 mm. The penetrating power of X-rays, though, varies, over this range.

Long wavelength X-rays (also called *soft* X-rays) are easily absorbed. Shorter wavelength X-rays (*hard* X-rays) have more energy and therefore more penetrating power. At their shortest wavelength, X-rays will easily pass through more than 0.5 m of steel. It is because X-rays can pass right through some, but not all, materials which appear opaque that X-ray photography works.

Dr. G. F. Leedale/Biophoto Associates

Producing X-rays

X-rays are produced by the collision of fast moving electrons with metal, glass or some other material. All this activity takes place in a tube.

An X-ray tube is rather like an ordinary tungsten lamp. A glass envelope surrounds a filament which becomes incandescent when a current is passed through it.

However, the similarity with household lamps ends there. In an X-ray tube there is in addition to the filament, a metal target (often high melting point tungsten) which attracts electrons from the heated filament when a high

voltage is applied to the tube. The higher the voltage, the greater the speed of the electrons and the shorter the wavelength of X-rays produced. When the electrons hit the target, most of their energy is turned into heat, but some become X-rays.

1,000,000 volts or more may be involved in the operation of some of the more powerful X-ray machines. Such powerful machines must usually be housed in rooms 10 m high and with walls 4 m thick.

The much less powerful machines used for medical examinations do not need quite as much protection but they are, nevertheless, housed in special areas.

X-ray films

At a casual glance, X-ray film is similar to conventional film—only in bigger sheets. Indeed, ordinary film is sensitive to X-rays. But there are some important differences.

For a start, most X-ray films are coated on both sides. This double coating provides more X-ray stopping emulsion, and therefore greater speed, while still keeping the emulsion layers thin enough for good processing uniformity.

All X-ray films are sensitive to light as well as X-rays. Some are intended for direct X-rays, for use in industrial applications, and have very slow emulsions.

Indigestion X-rays can reveal fractures, cancers or even, as here, a collection of household items swallowed by a patient and lodged in the intestine

Others are colour-sensitized so that they can be used with fluorescent screens. Such screens convert X-rays into visible light (generally blue or green) so that each exposure is made up partly from X-rays and partly from visible light. This increases the effective film speed.

Screens made with a coating of lead foil are sometimes used with high energy X rays. In one respect, these screens are rather like haze-cutting filters in conventional

photography since they absorb scattered X-rays that would otherwise reduce contrast. However, the screens also have another contribution to make. High energy X-rays actually cause the lead foil to emit electrons and secondary radiation, thus adding to the effect of X-ray exposure.

Use of X-ray photography

Strictly speaking, an X-ray photograph is a negative. It is actually the shadow graph of objects opaque to X-rays placed between the beam of X-rays and the sensitive film that records its presence.

Radiography, as this process is called, introduced something quite unique to the investigative world. Until the discovery of X-rays no one could see inside opaque objects without destroying them. Now, non-destructive investigation is so well established that technology and medicine could hardly function without it.

Medicine

Perhaps the most commonplace use of X-rays is in the radiographs produced in hospitals all over the world. By means of radiography, it is possible to carry out a thorough investigation of various aspects of the body painlessly, efficiently and swiftly. Bone fractures or diseases are clearly visible on the X-ray plate. The state of internal organs such as the heart, lungs and kidneys can be checked for problems without the need for surgery. The stomach and digestive system can be investigated by having the patient drink a solution of X-ray opaque barium sulphate. Commonest of all, perhaps, is the X-raying of teeth, allowing the dentist to uncover hidden problems or to discover the extent of visible ones.

Industry

Every ship that is built has to go through a thorough X-ray scrutiny test before it is launched. Such a procedure test the millions of joints, welds and plates in a modern hull, probing for imperfections so that they can be rectified before causing serious problems at sea.

Similar checks are made on aircraft, both while they are built and then periodically as part of the regular
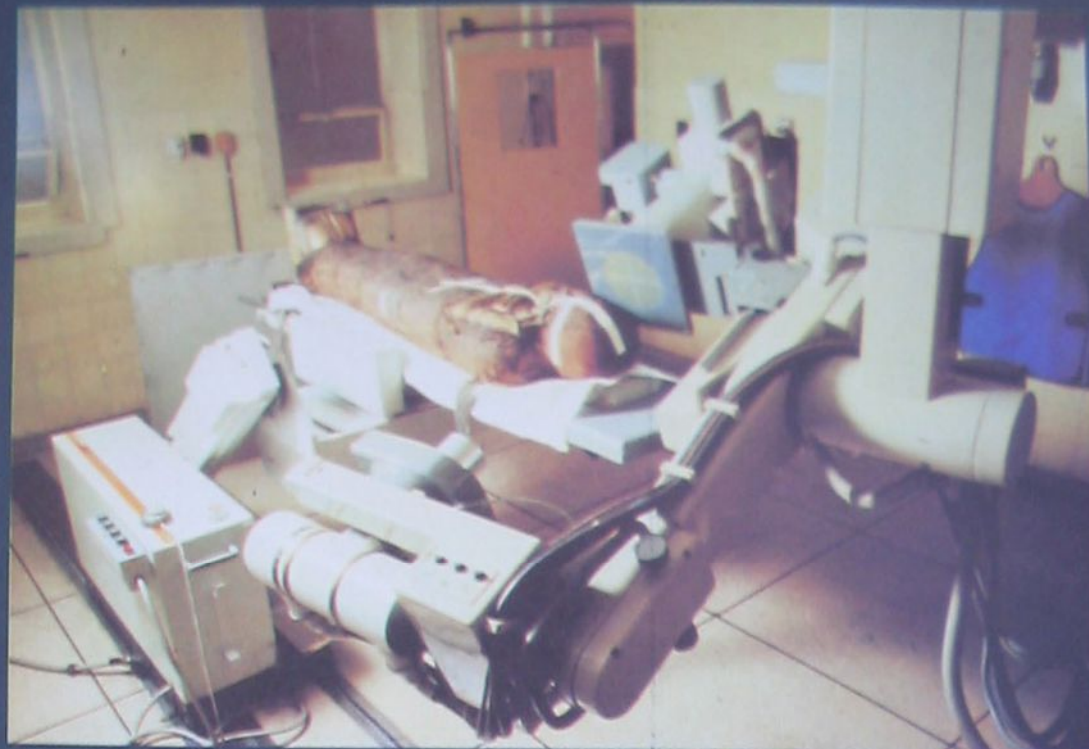
servicing procedure. Again these aim to reveal flaws in joints or riveted areas and to spot stress.

Specialized uses

Radiography has numerous applications in the worlds of art and archaeology. Art restorers can use it to establish the internal structure of a piece of sculpture, gaining vital knowledge of its hidden strengths and weaknesses before attempting restoration. Paintings can be examined to see whether they hide great works over which they have been painted. Plans and sketches can sometimes be discovered under famous works of art, giving some idea of the way they were constructed.

Similarly, archaeologists can use the power of X-ray to make the investigation and disinterring of Egyptian mummies less of a leap in the dark, or to find out more about how stone aged man lived—and how he died.

Mummy *X-ray examination has revealed important evidence of the lifespans, causes of death and geneology of mummies. It can even be used to trace trade routes by analyzing the cloth and establishing its origins*

Key *An X-ray photograph of this iron key, found at a medieval site in London, reveals its shape despite extensive rust. X-rays can also provide information on how an object was made, how it shouls be cleaned—even an obscured trademark*

PHOTOGRAPHY IN JAPAN

The enigma *One of a series of exotic and erotic images that Fujiwara took for his book 'Tapestry of Dreams' in the 1970s*

Although relatively unknown in the rest of the world, Japanese photography has developed a rich and varied tradition of imagery based on a unique cultural style

The kite man A famous incident in Japanese history adapted by Sakata for an advertisement

Nude Another dream like, surrealistic figure from Fujiwara's book Tapestry of Dreams

Kabuki actor An example of Sakata's humorous approach, this image is to advertise the Panasonic trouser presser

Silent Flowers One of the images from Yoshino Oishi's book exploring the feelings of Japanese women

2639

Hiroshi Hamaya 1947

2640
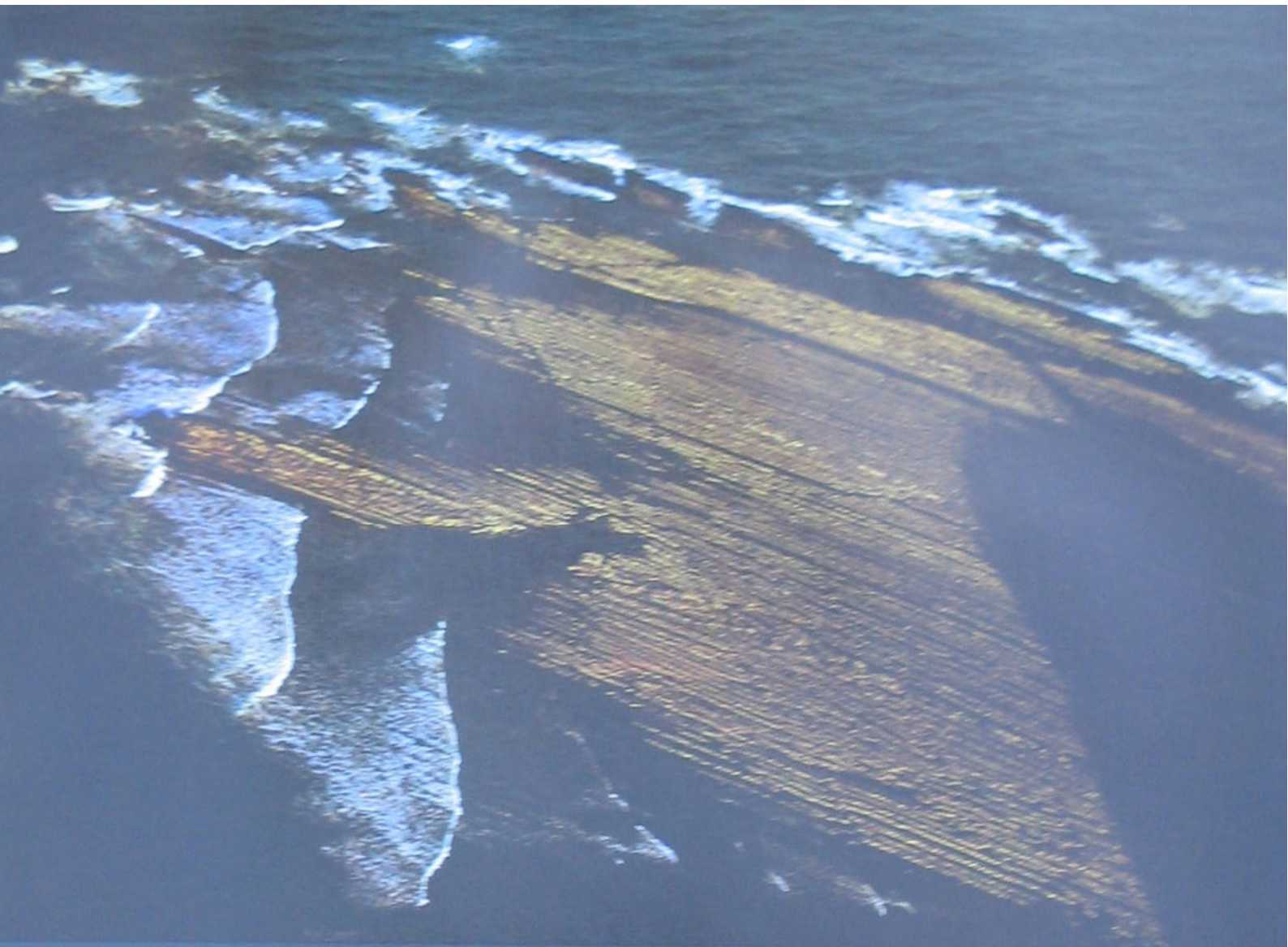
Mother and child From Yoshino's reportage on the people of Cambodia after the defeat of Pol Pot

Family group By her dramatic use of natural light Yoshino captured the tragedy of the Cambodians

Taiso Oda A portrait of the famous Japanese novelist, Taiso Oda taken in Takeba by Hiroshi Hamaya

Seascape Hamaya was one of the first of Japan's photographers to become world famous

Living in style Shinoyama's large format images from his book 'Japanese Houses' reflect their formal style

PHOTOGRAPHY IN JAPAN

Japan has been the world leader in the production of photographic equipment for two decades now. Names like Nikon, Canon and Olympus are synonymous in most photographers' minds with the highest standards of design and technical excellence. But although photographers everywhere—both professional and amateur—use Japanese cameras, Japanese photography is largely unknown outside Japan.

The boom in the photographic industry occurred simultaneously with the rapid development of industry after World War 2. Nowadays Japan is widely recognized as a highly developed country with a thriving economy, a high standard of living and a fascination for modern technology. However, it also has an ancient and unique culture that has traditionally put great emphasis on art and design. And, despite Western influences, these traditions were long ago carried over into that most modern of art forms—photography. Indeed Japanese photography has a history almost as old as photography itself.

The first daguerreotype camera probably arrived in Japan in the mid-1840s, just a few years after Daguerre published the instructions for his process. It was bought by Ueno Toshinjo Tsumetari, a clock and watch maker by profession, who had been asked to obtain this fascinating new process by the Lord of Satsuma and Governor of Kagoshima, Shimazu Nariakira. Shimazu was thus Japan's first patron of photography and in 1851 he established what was, in effect, Japan's first school of photography.

From this modest beginning, the practice of photography and the photographic industry have grown enormously. Today there are over 10,000,000

Today there are over 10,000,000 photographers in Japan and each year its factories produce 5,000,000 35 mm cameras and lenses

photographers in Japan and each year its factories produce 5,000,000 35 mm cameras and lenses. Picture-taking has become so popular that when steam-train enthusiasts recently arranged a special nostalgic train journey from Tokyo to Yokahama—a mere three kilometres—300,000 photographers lined the track to photograph the event!

In the middle of the last century, however, photography in Japan had a very uncertain future. From 1640 to 1853, during the Tokugawa Shogunate, Japan had deliberately cut itself off from the rest of the world. The only point of contact was a solitary Dutch trading post at Deshima visited by Dutch ships in which a tiny trickle of Western goods, including Nariakira's camera, arrived.

Such isolationism could not last forever. The Western powers, especially the United States, put so much pressure on Japan to lift her restrictions on trade that, at the start of the Meiji period in 1868, the country's new rulers felt obliged to adopt a policy of urgent industrialization and Westernization. Nevertheless for some time photography remained a hobby for the rich. This was partly because poorer people were still suspicious that the strange black box captured a piece of their souls as well as their likenesses, but mostly because it was extremely expensive.

In order to encourage the development of their own industries, very heavy taxes were placed on all imports. When one aspiring photographer, Kikuma Ueno, decided to open a studio, his Dallmeyer camera, paid for in gold, cost the equivalent today of the price of a new family saloon car.

Shimazu Nariakira 1857 *A daguerreotype of Japan's first patron of photography*

Despite the cost of photography, interest in it spread. Portraiture became particularly popular and, by the beginning of this century, there was already a fledgling photographic industry. Then, at about the same time, two things happened that helped to shape the future of photography in Japan.

The first was the rise in importance of the military. Japan had always had a powerful warrior caste, but the code of the Samurai was based on individual skills and loyalties and was quite out of place in an age of Maxim machine guns and heavy artillery. The Japanese government was well aware of how easily the European powers had colonized the rest of Asia and were determined that they would not suffer the same fate. So by 1894 not only did Japan have a modern army and navy on the European model, but she was also engaged in a colonial war of her own—battling with China over Korea.

With the advent of this war Japanese war photography was born. It was a tradition continued only ten years later when Japan went to war again, this time with Russia. Eleven photographers were dispatched to cover the fighting, taking a total of nearly 5,000 pictures.

From then on, until after World War 2, the military had a strong influence on Japanese society and consequently on the role of at least one aspect of photography in Japan. In time it was also to have a significant effect on the development of the Japanese photo-

When Kikuma Ueno decided to open a studio, his Dallmeyer camera, paid for in gold, cost the equivalent today of the price of a new family saloon car

graphic industry.

Meanwhile quite different influences were also at work. Many Japanese photographers had travelled or lived abroad, so not surprisingly their pictures tended to follow contemporary European and American movements in photography, especially the soft, impressionistic effects of pictorialism (see page 1504).

Foremost among these early artists was Shinzo Fukuhara, a gifted amateur, who had studied for six years in the United States and Germany. But Fukuhara was not content simply to imitate Western photographers and preferred to adapt pictorialism to his own particularly Japanese style. Fukuhara compared his photographs to *haiku*, the traditional 17 syllable poems greatly admired by all Japanese for their ability to conjure up a place and a mood with the utmost economy.

The gentle photographic poems of Fukuhara and the grisly pictures of the war photographers seem to be poles apart, and the history of Japanese photography does often appear to be split into two distinct camps. On the one hand there was a firm, unflinching documentary style and, on the other, the creation of an elaborate fantasy world. However, the two sides are brought together by the traditional Japanese view of art as a personal, intuitive statement about reality rather than a straightforward description of it. Several contemporary Japanese photographers have happily alternated from one camp to another, doing hard hitting reportage work one year and exotic fashion photography the next.

Between the two world wars, however, it was documentary photography that had the upper hand. In those years amateur and professional photography both made tremendous leaps forward. The 1914–1918 war had given a big boost to the Japanese economy and greatly raised the living standards of the middle

classes. With more money to spend, many turned to photography as a hobby. Photographic clubs sprang up everywhere. The first was founded in 1921 and within a few years over 200 were registered. The thriving economy also benefited commercial and advertising photography and by 1926 there were 180 studios in Tokyo alone.

This period of prosperity bypassed the poor for whom life remained hard and wretched and, for the first time, there were strikes and riots in Japan. Before long the military, fearing that the nation was becoming corrupted by 'Western decadence', began to put pressure on the government to end its experiment in liberalism, so that by 1931 it was the military, and not the government, that in effect ran the country.

Just as similar events in Europe saw the birth, and near extinction, of modern photojournalism (see page 2324), so in Japan too photographic realism and reportage made great headway during the late 20s and into the early 30s under the leadership of, among others, Ihei Kimura who was in many ways the Cartier-Bresson of Japan.

In 1929, while still a studio photographer, Kimura was shown a Leica by the captain of a visiting German Zeppelin. He immediately realized its possibilities and sold all his equipment to buy one for himself. Kimura changed his style too, he started photographing everyday life in the streets, using only available light and never cropping his pictures. In 1933, he held an exhibition of Leica photography. The exhibition was an enormous success and the *Asahi Shimbun*, Japan's largest selling newspaper, carried his work every day for a month.

A life-long friend of Kimura's was the studio and advertising photographer, Iwata Nakuyama. Also an important influence on Japanese photography, but in a totally different way, Nakuyama produced a series of experimental collages and photograms. While clearly influenced by the work of Europeans like Man Ray and Moholy-Nagy, these were essentially Japanese in feeling and style. The close friendship of these two very different photographers indicates how easy it was for the two opposing themes of Japanese photography—realism and fantasy—to live in harmony with each other.

The technical progress of Japanese photography during this period was less spectacular. Although the home-based companies steadily increased production of film and printing paper, cameras were still being imported in large numbers. Nevertheless in 1936 11,000 Japanese cameras were exported to Berlin for the Olympics. The Japanese photographic industries had made their first step towards world leadership. The following year, the military gave them some unexpected help by banning the import of all foreign films and papers—neatly relieving domestic producers of all competition.

At the same time, photographic technologies that could be militarily useful,

> *. . . it was easy for the two opposing themes of Japanese photography— realism and fantasy—to live together in harmony*

such as the development of aerial photography or of underwater cameras, were given active encouragement and substantial government grants. Then, when Japan declared war on the United States in 1941, she simultaneously seized all American companies still operating in Japan and handed them over to Japanese firms. The Fuji Film Company had the good fortune to be presented with all Kodak's Osaka branches. This gift included their processing equipment and the secret technical information that went with them.

The bitter fighting in the Pacific dominated Japanese photography throughout the war. One agency had no less than 64 photographers in the field. Although most of the pictures published were pieces of blatant propaganda, the

> *The period immediately after the war was one of struggle and hardship . . . it is hardly surprising that documentary photography was again the dominant theme*

bravery of individual cameramen was never in doubt. They were always to be found in the front-lines and many were killed or wounded.

Both the fact and the manner of their defeat in 1945 left the Japanese people stunned. For days, survivors wandered aimlessly around the wreckage of Hiroshima and Nagasaki unable to comprehend what had happened. Although film was by now in desperately short supply, photojournalists Eiichi Matsumoto and Yasuo Tomishige took fifty 35-mm rolls of the devastation, while a local studio owner, Tarahika Ogawa, photographed the survivors every day for 40 days, recording the full horror of the blast burns and the slower agony of radiation poisoning. All these pictures, however, had to be carefully hidden until after the Peace Treaty of 1952. If the Allied Occupation forces had got hold of them they would almost certainly have been destroyed.

Except for a modest amount of censorship, though, the effects of the Allied Occupation were usually those of reform and liberation rather than repression. Although not allowed to criticize the Allied Forces, the press were free to write about anything else and, for the first time in Japan, men and women were given equal rights. As part of the drive to get the Japanese economy back on its feet, the Americans also encouraged the photographic industries to increase production, though it was a few years before they were back to even pre-war levels of production.

The period immediately after the war was one of struggle and hardship for Japan. It is hardly surprising then that documentary photography was again the dominant theme. Kimura was still Japan's leading documentarist but now he was joined by Ken Domon, a staunch advocate of photographic realism. Domon used his position as picture selector for the prestigious *Camera* magazine to good effect in promoting his point of view and this was also reflected in his own pictures of Japan's outcasts, vagabonds and street-urchins.

Another favourite photographic theme was the nude. This had long been a

Woman photographed in Paris, 1914 *by Fukuhara showing the pictorialist influence*

Shinzo Fukuhara 1914

popular subject for both Japanese photographers and painters, but such activities were distinctly discouraged by the authoritarian and prudish governments of 1931 to 1945. Now photographers returned to the subject enthusiastically, as a joyous expression of their freedom and a string of highly successful books on nude photography appeared.

Apart from appearing as models in best-selling picture books, the role of women in Japanese photography has been surprisingly small. There are no Japanese Julia Margaret Camerons or Margaret Bourke-Whites. Japanese society is extremely patriarchal by tradition. Even today equality of the sexes exists far more in name than it does in practice and, although in 1951 a women's photographic association was formed only occasionally does a woman's name appear in the ranks of Japanese photographers.

A recent exception is Yoshino Oishi, who combines in her work the two great opposites of Japanese photography. Of

Ihei Kimura 1952

The Youths, 1952 *Kimura was often called the Cartier-Bresson of Japan*

The ability to combine two, or more, very different photographic roles is far more common in Japan than in many other countries

her two major works, one is a book of documentary photographs taken in Cambodia between 1975 and 1978. This deals with that country's attempts to rebuild itself after the years of chaos and massacre under the Pol Pot regime. The other is totally different—a collection of expressive images called *Silent Flowers* which explores the traditional feelings of Japanese women.

The ability to combine two, or more, very different photographic roles is far more common in Japan than in many other countries. One of Japan's most famous photographers, Kishin Shinoyama also demonstrates this ability. Using every format from 35 mm to 5 × 4 and every lens from extreme wide angle to extreme telephoto, Shinoyama has covered an astonishing range of assignments. His photographs include gritty black and white reportage work on the tattoo parlours of downtown Yokahama, glossy travel pictures for the Australian airline Qantas, and poetic atmospheric photographs for a limited edition book on traditional Japanese houses, copies of which sold for £600.

Perhaps the most outstanding of contemporary Japanese photographers is Hiroshi Hamaya, who first started as a freelance photojournalist in 1937. Hamaya's work ranges over a wide variety of subjects, but his favourite themes are Japanese folklore and the relationship between man and nature. Although most of his work has been photojournalism—he joined Magnum in 1960—Hamaya's work has also been in a large number of books and exhibitions,

and he too illustrates the ability to combine two different roles, artist and photojournalist.

Equally important to modern Japanese photography are the fashion photographers. As Japan's economic recovery gathered momentum during the late 50s and 60s, the effects of Westernization spread, into the field of fashion design as much as anywhere else, and the need for fashion photography grew. This was good news for many Japanese photographers who soon found that their traditions of photographic fantasy were particularly suited to this kind of photography.

Of all Japanese fashion photographers, probably the most widely respected and the most original is Hiro. Although now resident in America, Hiro (Wakabayash Yasuhiro) was brought up in Japan in the 30s and 40s. Like many of his generation he was strongly influenced by the American way of life which had been imported into his homeland by the Allied Occupation Forces

The magazine industry in Japan is complemented by a thriving book publishing industry, renowned for the high quality of its photographic reproductions

after World War 2. At the age of 23 he left Tokyo to study photography in New York, where he soon became Richard Avedon's assistant. But Hiro never forgot his Japanese background and his fashion work is full of the subtle fantasies, sometimes amusing, sometimes disturbing, always highly creative, that are characteristic of the best in Japanese photography.

For younger photographers too, the American experience exercises a deep attraction. Although Japan today is economically one of the world's most powerful nations, she still has strong cultural and emotional links with the United States as well as some healthy

trade agreements.

Ikko Narahara is a leading figure in the new generation of Japanese photographers, yet his best known work—the book *Where Time Has Vanished*—is a record of an extended trip to America in the mid 70s. Once again, though documentary in style, the pictures are within the traditions of Japanese art, an intriguing mixture of reality and fantasy, like photographs of a dream. Working in all camera formats, but mostly with black and white film which he prefers for aesthetic reasons, Ikko is famous as an artistic photographer, not a commercial one, and his work has been shown in many galleries all over the world.

In Japan itself there are few photographic galleries, but this is more than made up for by the huge number of excellent photographic magazines available. These regularly publish pictures taken by their readers as well as those by more famous photographers, and the number of these magazines is growing constantly. In 1981 alone five new photographic magazines appeared on the news-stands.

The magazine industry in Japan is complemented by a thriving book publishing industry, renowned for the high quality of its photographic reproductions. The result is that photographers in Japan seem to have books published as frequently as their Western counterparts hold exhibitions. Ikko already has seven books to his credit and even some comparatively unknown photographers have had one or two printed.

When Japan began her painful rebirth from the chaos of World War 2 many of her critics regarded their products as cheap imitations of Western goods. Today they are recognized as the world-leaders they are. The significance of a country's artists is harder to recognize than the quality of its material goods, but even though it is not always understood, Japanese photography can no longer be ignored. The world is waking up to the fact that Japanese photographic images are as important as Japanese photographic equipment.

What went wrong?

JUDGING SEA PICTURES

From the semi-abstract close-up to the general view, it is the thoughtfulness of approach which marks the successful sea photograph as our judges found with these five pictures

A

B

C

D

E

The Photographers' Choice:

John Sims	**A D C B E**
Homer Sykes	**C B A D E**
Ian McKinnell	**D E A C B**
Colin Molyneux	**A D B C E**

There was a large degree of agreement among the panel about the order of these sea pictures. A and D did consistently well, probably because, as John Sims said, 'they concentrate on specific aspects of the sea which are simple, clear and unmistakable.' John Sims and Colin Molyneux both put A as their first choice—Molyneux for its 'sheer originality', Sims 'because the photographer has consciously thought about composition.'

Ian McKinnell was very impressed by D: 'It is a perfect example of how much a relatively simple image can say—conjuring up as it does thoughts of summer, of the sun, of the Mediterranean . . . a beautiful photograph.' He put E second, saying that 'it possesses some of these qualities, but it has a different, less soothing mood to it, imparting thoughts of another season, another country.' Interestingly all the other photographers placed E last, Colin Molyneux picking it out 'as it really hasn't enough action to make it successful.'
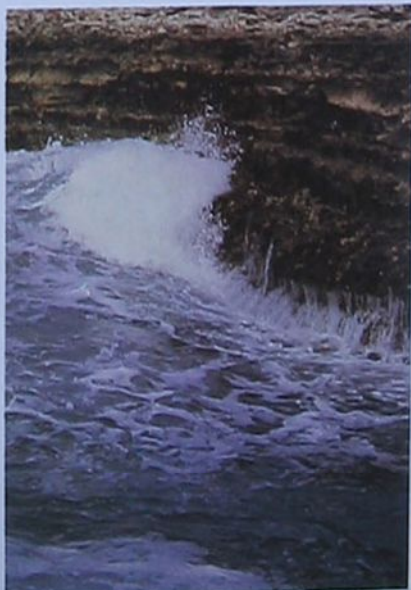
Homer Sykes's stood out as an unusual selection. Most of the panel were not particularly impressed by C but he placed it first, liking 'the way the photographer has deliberately under-exposed the photograph, taking his reading from the white surf. This darkens the picture and heightens the dramatic effect.' Homer Sykes also like B, though he said 'It could have been improved if the photographer had waited or changed his angle slightly so as to silhouette all three people.'

It is perhaps interesting to note that although different photographers were impressed with different photographs they often spoke of the same quality—a thoughtful approach to the subject.

Creative approach

eye to eye

One of the best ways of developing an eye for a picture is to look at the
work of others. Here we examine pictures by some of the world's best photographers
to find out just why they work so well

One of the most stimulating ways of developing an eye for a picture and an awareness of the possibilities in creative photography is to study the work of people who have excelled in their respective fields. Here we have reproduced images from a range of photographers and subjects—each one illustrates a particular aspect of the creative approach.

By studying these images and analyzing how the 'rules' of creative photography have been exploited—or disregarded—you can familiarize yourself with the photographic decisions which should be a part of your own picture taking process. Even though creative photography can be spontaneous and working methods vary considerably it is important to realize that images such as the ones shown here result from very deliberate decisions about light, composition, depth and tone or colour.

Of course, even the greatest photographers have to accept that luck plays some part in the whole process and that happy accidents are not unknown. So it is important not to adopt such a concentrated approach that you close yourself off to lucky breaks. Similarly, experimentation is very important—try different ideas and do not be discouraged if they often fail. By noticing how others have dealt with their subjects and always being prepared to try something different yourself you will move towards a more individual

Landscape When photographing rural scenes like this it is hard to overlook the basic rules of composition. Here the fence is important—it gives foreground interest and leads the eye to the middleground, thereby creating a sense of depth. The rule of thirds has also been applied—the foreground occupies the lower third and the horizon the upper third, while the gate is given prominence by framing it on an imaginary vertical third. The overall warmth of colour also contributes to the image's appeal

interpretation of even the simplest scene—the personal vision that distinguishes creative work from the snapshot.

355
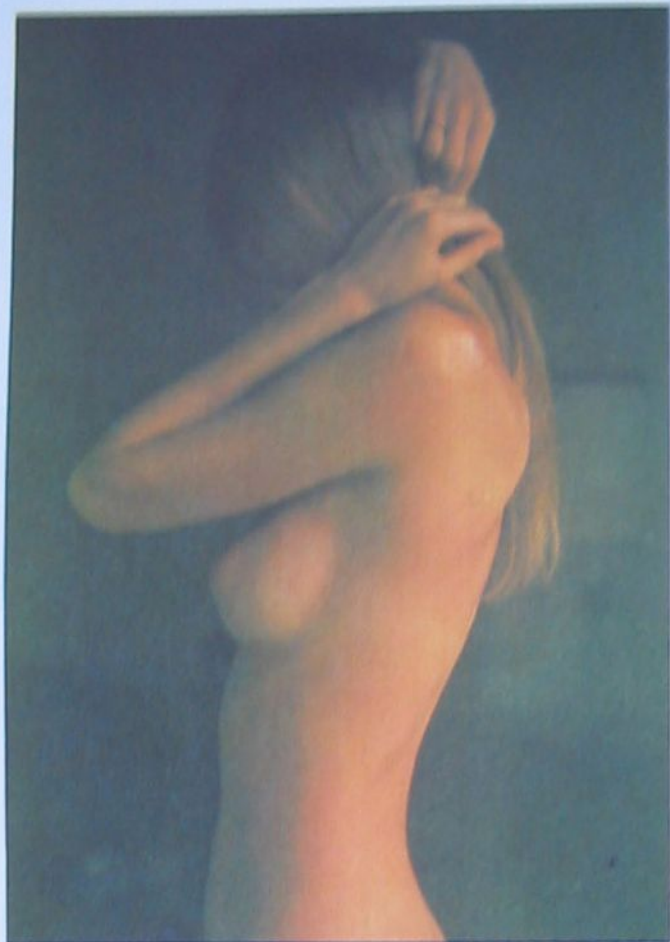
David Hamilton/The Image Bank
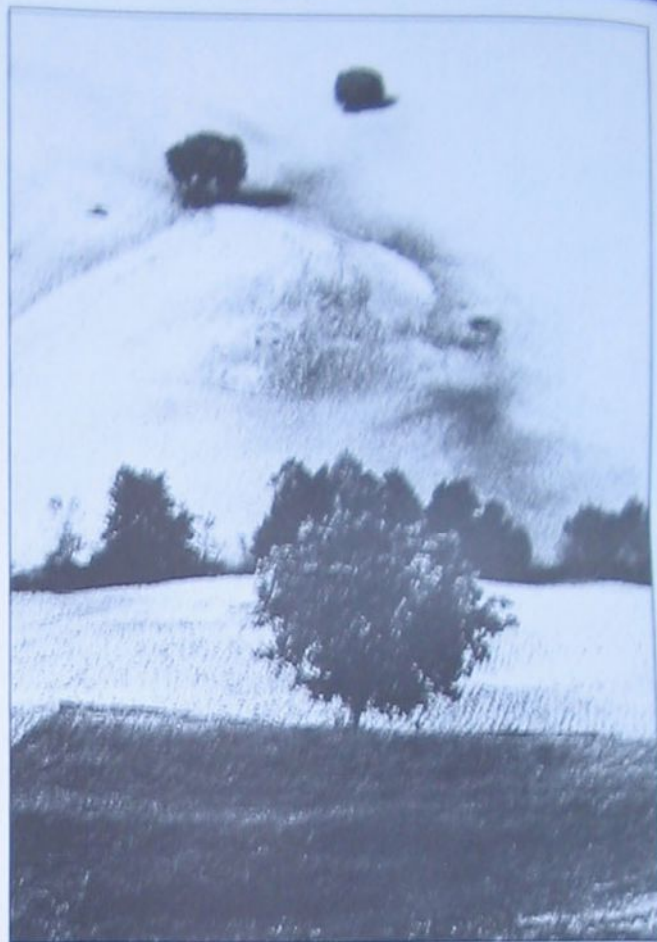
Mario Giacomelli/Contrasts

cantabrian
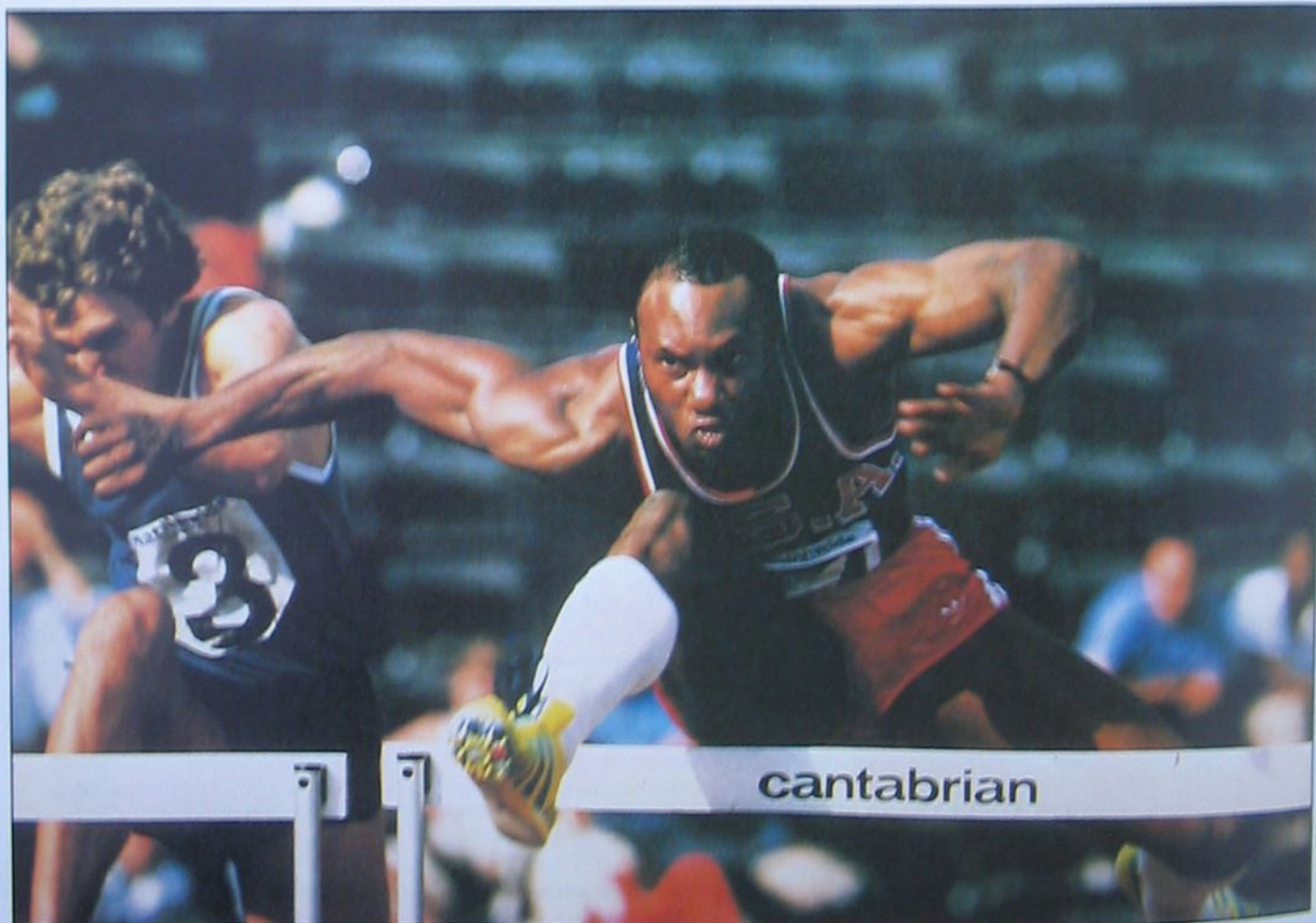
Tony Duffy/All Sport

Nude David Hamilton is well known for his dreamlike images of young girls— a quality often produced by using soft focus techniques. Here the effect has been created in a more subtle way, by shooting through a screen door— similar in effect to using a texture screen. The softness of the natural light and the relaxed pose both enhance the romantic atmosphere that has become Hamilton's trademark.

Monochrome field Giacomelli also has a very distinctive style but this is usually manifested in high contrast, grainy black and white landscapes. The effect is achieved by his choice of subject and over-development of the 120 film he uses. He also manipulates images on occasions by scratching marks directly on to the emulsion of his negative—he sometimes even uses a tractor to plough designs in the fields! While composition is still an integral part of this image, his own approach to landscapes is to rely heavily on pure shapes and tone, aiming for a more impressionistic interpretation of the region.

The hurdle Sports photographers are all expected to produce crisp, clear images of the action involved. But what really distinguishes the creative sports picture is graphic shapes and peak-of-the-action moments caught on film. Here this is illustrated by the athlete's determined face, his leg just forced over the hurdle and his taut, muscular outstretched arms

Truck Harsh, polarized light gives a hard edge to this simple but graphic image of a truck stopped on a lonely road in the American West. Pete Turner exploited the stretched perspective of a 20 mm lens to fill a large part of the frame with the bright chromework and set the overpowering machine against the natural beauty of the rocky landscape. The lines on the road break up the dull colour of the foreground and the key elements of the composition fall into horizontal and vertical thirds

Mexican building The bold blocks of colour, the hard diagonal shadow breaking up the foreground and the small but significant figures silhouetted against the pink wall, all combine to create a strong enigmatic image. René Burri has shown here that important elements of a scene need not occupy a large part of the frame to be significant. The shot also shows how patience is rewarded by waiting for the right moment—the figure completes the photograph

Snowdon

Ernst Haas/Magnum
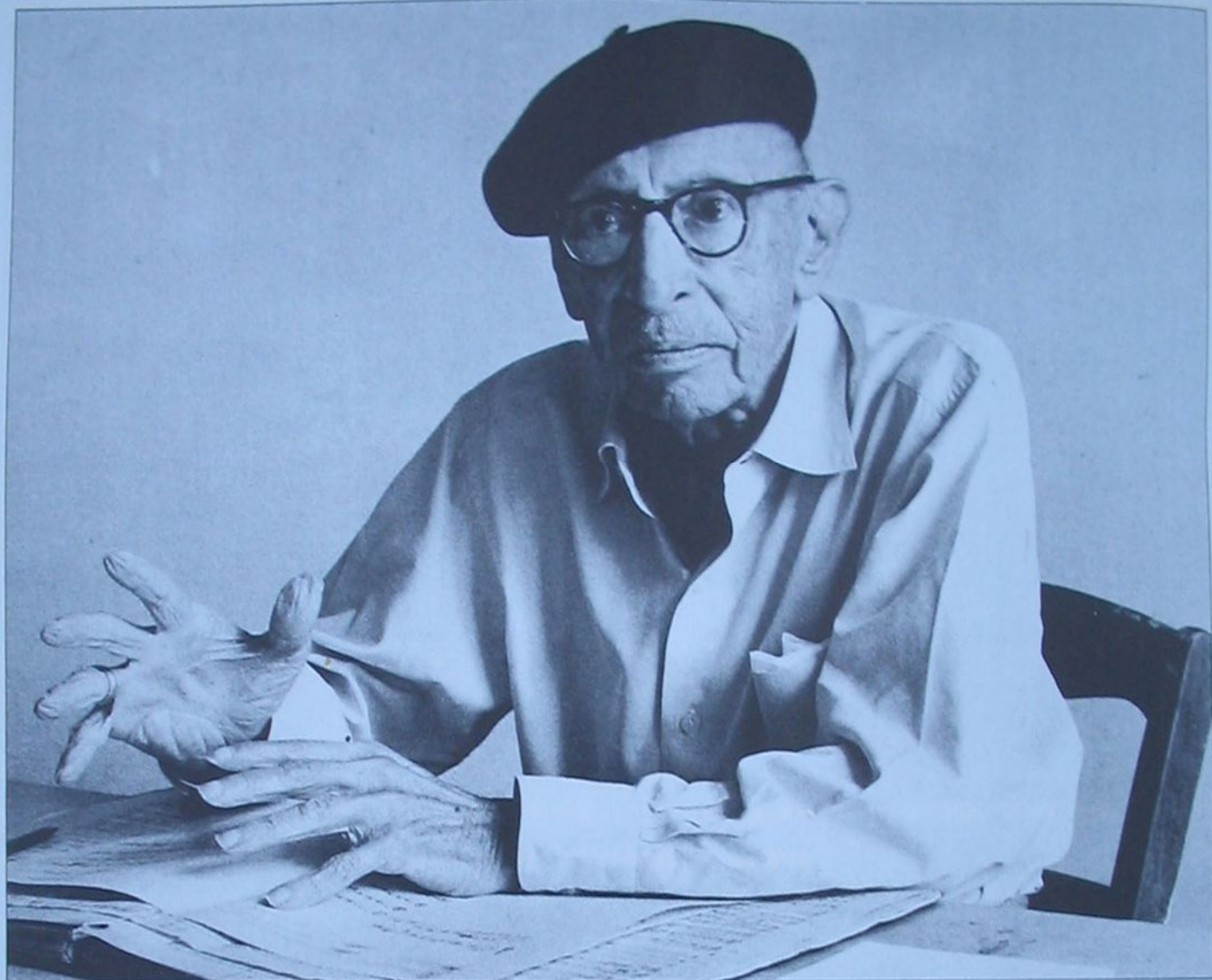
Stravinsky *With portraiture, just as with sport, choosing the right moment to press the shutter is half the battle. Here Snowdon captured a moment of animation, generated, in particular, by the composer's hands which have become a very important part of the overall shot.* **Wave washed coral** *The tiny pools of seawater lodged in a piece of coral magnify sections of the beach and sky in this close-up study by Ernst Haas. The image shows what can be done by looking at the world in detail. Each hole in the coral resembles a cell seen through a microscope and contribute to the theme of 'Creation'—the book in which this photograph appears.* **New York street scene** *Here again, compositional 'rules' have been observed—vertical elements are divided into thirds just as the figure and the cat are positioned a third of the way up the frame, producing a pleasing compositional arrangement. The wall and curbs lead the eye straight to the centre of interest. An image like this is the result of careful observation and an ability to react quickly and instinctively to make the best of things before the subject becomes aware of the camera or the scene changes*

Chemicals A-Z

For success in the darkroom, you must be familiar with all the materials. This glossary provides a quick and easy to follow reference to all the common chemicals and formulae and what they are used for

If you are a keen darkroom worker you are bound to be surrounded by a variety of chemicals. Some of these will be in constant use, and others only from time to time. This ready reference guide, which you can keep handy at all times, should help you to instantly identify all the most common darkroom chemicals and their uses in photography.

Most darkroom chemicals are fairly easy to obtain and relatively safe when used and handled properly (see page 1561). Some, however, have varying degrees of toxicity and can only be obtained from a pharmacist or a listed supplier.

Regulations differ throughout the world, but as a guideline any substance found on the poisons list in the UK (marked * in this list) is usually subject to restrictions elsewhere. If a chemical is on the poisons list then you have to convince the pharmacist or supplier that you have a satisfactory reason for needing that particular material. Quite often you have to be known to the pharmacist personally, and even then you must sign a declaration giving the reason for purchase. Sale is always at the personal discretion of the individual pharmacist or supplier.

When you buy an unfamiliar new chemical be sure to ask about its storage in case there are any important points you should be aware of. In all cases make sure that jars and bottles are clearly labelled, so as to avoid confusion. It is also a good idea to label stoppers.

Acetic acid, $CH_3 COOH$, is a water soluble, colourless corrosive solution that smells like vinegar and is used in stop baths, fixers and hardeners. An 80 per cent solution is available from photographic suppliers. Concentrations over 98 per cent are known as glacial acetic acid because it freezes below 16.5°C. You should store it in airtight bottles to prevent it absorbing moisture from the air, and avoid splashes or breathing the fumes.

Acetone, $(CH_3)_2 CO$. This colourless, sweet smelling, flammable liquid dissolves easily in water or alcohol and is used for repairing celluloid film. It should be stored away from heat in stopped bottles to prevent evaporation. Avoid breathing the fumes.

Alcohol, $C_2H_5.OH$. Various types are available but industrial methylated alcohol is best for photographic use. It is a colourless flammable liquid that evaporates readily and smells slightly sweet. It is used for cleaning and rapid drying of films, and should be stored away from heat in stoppered bottles. Purple coloured methylated spirit should not be used as a substitute as there is a risk of dissolving the film base. Avoid breathing the fumes.

Amidol, sometimes called diamino-phenol, formula $C_6H_3OH(NH_2HC1)_2$, is a bright grey powder that dissolves in water to give a solution that is corrosive and stains anything it touches. Used as a developing agent, this chemical should be stored in clear airtight bottles so its colour can be seen because if it turns brown it should be thrown away. The solutions should be used immediately as it has poor shelf life, but the powder keeps quite well.

*Ammonia, NH_3. A clear, sharp smelling gas normally supplied in 35 per cent solution form that is known as 0.880 (eighty-eight) ammonia—a measure of its specific gravity. It is a strong alkali, soluble in water and used for hypo elimination in prints. This substance is on the poisons list and supply is restricted through pharmacists. It must be stored in tightly capped polythene bottles in small quantities and used in well ventilated conditions. Avoid splashes and breathing the fumes.

Complete control *Only if you are very familiar with chemicals used in processing can you get the most out of any image*

Ammonium bichromate. Also known as ammonium dichromate, $(NH_4)_2 Cr_2 O_7$. Orange crystals soluble in water and often used as an alternative to potassium dichromate in the gum dichromate and carbro processes. It is a corrosive agent and should be stored in reasonably dry conditions to prevent crystals sticking together. See also sodium bichromate.

Ammonium chloride, sometimes referred to as sal-ammoniac NH_4Cl. This is a white crystalline powder that dissolves freely in water and is a constituent of rapid fixers; it should be kept dry to prevent the crystals sticking together, and is a mild corrosive. There are no restrictions on supply or storage.

Ammonium persulphate, $(NH_4)_2 S_2 O_8$, is a white crystalline powder that is very easily dissolved in water and used for toning and reducing. It must be kept in airtight jars because it absorbs moisture from air and loses strength. Any solution prepared should be used at once. This is flammable and corrosive and a similar chemical to potassium persulphate.

Ammonium thiosulphate, $(NH_4)_2 S_2 O_3$. A clear, corrosive material in crystal form that is soluble in water and used in

high speed fixers. Readily available, it should be stored in airtight glass jars to keep moisture out.

Borax, also known as sodium biborate, formula $Na_2B_4O_7.10H_2)$. This is a white crystalline powder that is fairly soluble in hot water and finds use as an accelerating alkali in some developers. There are no restrictions on supply or storage.

Chlorquinol, sometimes called Adurol or chlorhydroquinone, $C_6H_3(OH)_2Cl$, is a fairly soluble white crystalline powder used for warm tone developing. It is easily available but mildly corrosive and should be stored in glass jars.

Chrome alum is the common name for potassium chromium sulphate, $KCr(SO_4)_2.12H_2O$. These violet crystals dissolve in water at room temperature to give a purple coloured solution that is used in the preparation of hardening baths. Heating the solution turns it green and renders it ineffective. It is a readily available substance that can be stored in glass. Ammonium chromium alum $NH_4Cr(SO_4)_3.12H_2O$, is used as a substitute.

Copper sulphate, $CuSO_4.5H_2O$, used to be called blue vitriol and is available in soluble blue crystal form. It has many photographic uses including bleaches, intensifiers and toners, but supplies may be subject to restriction since it is a poison. Airtight storage is important because the crystals absorb moisture from the air.

Developers

Kodak D19. An excellent high contrast negative developer suitable for continuous tone and line work.

water at 50°C	500.0 ml
Metol developing agent	2.0 g
Hydroquinone	8.0 g
sodium sulphite anhydrous	90.0 g
sodium carbonate anhydrous	45.0 g
potassium bromide anhydrous	5.0 g
add cold water to make up to	1.0 litre

Kodak DK50. A fairly high contrast developer suitable for increased speed.

water at 50°C	500.0 ml
Metol developing agent	2.5 g
sodium sulphite anhydrous	30.0 g
Hydroquinone	2.5 g
Kodalk balanced alkali	10.0 g
potassium bromide anhydrous	0.5 g
add water to make up to	1.0 litre

This is the stock solution suitable for dish development and should be diluted 1+1 for tank working.

Kodak D76. A normal contrast clean working developer. Stock solution may be used neat or diluted 1+1.

water at 50°C	750.0 ml
Metol developing agent	2.0 g
sodium sulphite anhydrous	100.0 g
Hydroquinone	5.0 g
borax	2.0 g
add water to make up to	1.0 litre

Kodak D163. An excellent developer for dish processing negatives and prints, giving neutral to warm tones according to the paper.

water at 50°C	750.0 ml
Metol developing agent	2.2 g
sodium sulphite anhydrous	75.0 g
Hydroquinone	17.0 g
sodium carbonate anhydrous	65.0 g
potassium bromide	2.8 g
add water to make up to	1.0 litre

This is the stock solution and is diluted 1+3 for use with bromide papers.

Crawley's FX1. A high acutance developer giving an increase of up to one stop in film speed.

Metol developing agent	0.5 g
sodium sulphite anhydrous	5.0 g
sodium carbonate anhydrous	2.5 g
potassium iodide 0.001 % solution	5.0 ml
add water to make up to	1.0 litre

This is a one shot developer and to make the 0.001 per cent solution you can dissolve 1 g of potassium iodide in 1 litre of water.

Farmer's formula reducer is a subtractive chemical for removing equal amounts of silver density from all the tones in a negative.

stock solution A	
potassium ferricyanide	37.5 g
water to make up to	500.0 ml

stock solution B	
sodium thiosulphate crystals	480.0 g
water to make up to	2.0 litre

1 part stock A + 4 parts stock B + 27 parts water gives you a working solution that has a fairly short life, so mix imediately before use. To remove yellow stains caused by reduction, clear the negative in a fresh acid fixing bath.

Ferric ammonium citrate, $Fe_2(NH_4)_2$ $(C_6H_5O_7)_3$. Takes the form of brown or green crystals that are light sensitive and soluble up to dilutions of 1 + 4 but no

Stop bath indicator *When the normal yellow colour of the solution turns purple, it is time to replace the exhausted solution*

Tessa Musgrave

stronger. The green crystals are preferred for toning processes although the brown crystals are more commonly available.

Ferric chloride, $FeCl_3.6H_2O$, often called iron chloride, takes the form of yellow crystals that readily absorb moisture and are very soluble in water. It is used mainly in the blueprinting process and there are no restrictions on this mildly corrosive substance which should be stored in airtight jars. It is also available in a dehydrated and more contentrated form known as ferric chloride anhydrous, formula $FeCl_3$; in this form it is also soluble in alcohol or ether and because of its concentration it is more active in use.

Fixers

Plain acid fixing bath.

sodium thiosulphate crystals	250.0 g
sodium bisulphite	20.0 g
water to make up to	1.0 litre

Kodak F24 non hardening fix bath.

water at 50°C	600.0 ml
sodium thiosulphate	240.0 g
sodium sulphite anhydrous	10.0 g
sodium metabisulphite	25.0 g
water to make up to	1.0 litre

Kodak F7 rapid fixer bath.

water at 50°C	600.0 ml
sodium thiosulphate	360.0 g
ammonium chloride	50.0 g
sodium sulphite anhydrous	15.0 g
acetic acid 80 per cent solution	17.0 ml
boric acid crystals	7.5 g
potassium alum	15.0 g
water to make up to	1.0 litre

NB. Prolonged immersion of fine grain materials is not recommended in this bath as some bleaching may occur.

Alternative high speed fixer.

ammonium thiosulphate	175.0 g
sodium sulphite anhydrous	25.0 g
glacial acetic acid	10.0 ml
boric acid crystalline	10.0 g
water to make up to	1.0 litre

Formalin is a 40 per cent solution of *formaldehyde (HCHO)*, which is a colourless, sweet and slightly pungent gas that is used in hardening and tanning agents; it is also the main part of stabilizers in colour processing. Formaldehyde is extremely dangerous and you must be very careful indeed when handling it. The fumes may cause bronchial reactions in some cases and so good ventilation is needed. Restrictions apply to this corrosive poison, which should be stored in dark brown airtight bottles to prevent decomposition and release of fumes.

Glycerine, $(CH_2OH)_2CHOH$. A clear viscous and apparently oily liquid that is soluble and used for printing badly scratched negatives.

Glycin, sometimes known as Kodurol, $C_6H_4(OH).(NHCH_2CO_2H)$, is a white

powder that only dissolves in solutions of other alkali solutions. This is a clean working developing agent and should be readily available since no restrictions apply to the purchase or storage of this material.

Gold chloride is chlorauric acid $AuCl_3.HCl.4H_2O$, a yellow crystalline material that absorbs moisture from the air at great speed. It is freely water soluble and is used in toning negatives and prints for improved permanence (see page 1247). Although mildly corrosive it is readily available but expensive.

Hardeners
Kodak SH1 Formalin prehardener, for negatives that are to be immersed in chemical treatment baths.

water	500.0 ml
formaldehyde 40 per cent solution	10.0 ml
sodium carbonate anhydrous	5.0 g
water to make up to	1.0 litre

Kodak F5a hardening bath solution to add to plain fixer solutions.

water at 50°C	600.0 ml
sodium sulphite anhydrous	75.0 g
acetic acid 80 per cent solution	82.0 ml
boric acid crystals	37.5 g
potassium alum	75.0 g
water to make up to	1.0 litre

Add one part of this stock solution to four parts of fixer solution and stir rapidly.

Hydrochloric acid, HCl, is a colourless concentrated solution of a common acid releasing fumes with a rather pungent smell. This freely soluble acid is used in a variety of clearing baths and especially in platinum printing, but restrictions apply since it is a highly corrosive poison and the fumes released cause choking. It should be stored in glass jars in small quantities to minimize accidents, and only used where there is good ventilation.

Hydrogen peroxide, H_2O_2, is a pale blue solution freely mixed with water for use in bleaches and hypo eliminators. In use this solution releases oxygen and the labelling indicates this activity, for example a 20 volume solution (6 per cent) will release more oxygen than a 10 volume solution (3 per cent). Good ventilation is needed to minimize the risk of ignition and the solution should be stored in airtight jars in a cool dark environment.

Hydroquinone, also known as quinol, $C_6H_4(OH)_2$, is in the form of off white fine needle shaped crystals that are soluble in hot water. It is a popular developing agent and is readily available although mildly corrosive. It should be stored in airtight glass jars and not plastic, because quinol is sensitive to moisture and static electricity, and the crystals may jump around as a result.

Indicator solutions.
Kodak ST1 indicator test for residual

silver

water	125.0 ml
sodium sulphide anhydrous	2.0 g

This stock solution has a shelf life of 10 weeks and must be diluted 1+9 for use (see page 2526).

Kodak HT2 indicator test for residual hypo

water	750.0 ml
acetic acid 28 per cent solution	125.0 ml
silver nitrate crystals	7.5 g
water to make up to	1.0 litre

Store in an airtight brown bottle away from heat and light. Anything coming into contact with this solution will be stained black.

Kodak FT1 indicator solution for testing fixer bath's performance.

water at 26.5°C	750.0 ml
potassium iodide	190.0 g
water to make up to	1.0 litre

Indicators for stop bath life are usually either bromocresol green or bromocresol purple. Both of these are standard laboratory indicators and are sensitive to changes in pH in the way that litmus is and they all respond to a drop in acidity by changing to a darker colour. For example, a healthy stop bath will look yellow or orange if it has bromocresol purple in it, and when exhausted will be a blue violet colour. These chemicals are available from your pharmacist.

Mercuric chloride, $HgCl_2$ (mercuric perchloride), is an extremely toxic white powder that is slightly soluble in water at room temperature. It is used in certain intensifying formulae (see page 1723) and contact must be kept to a minimum by use of gloves and good ventilation. It must be stored in airtight glass jars. Restrictions on supply are strongly enforced since even small amounts of this material are very toxic. So it must be handled with extreme caution.

Hypo test *You can test washed and dried prints—usually off the actual image area— for residual hypo in archival processing*

Metol, also called Rhodol, Elon or Pictol, formula $(CH_3 NHC_6 H_4OH)_2 H_2 SO_4$ is a white crystalline powder that is fairly soluble at room temperature, but less soluble in alkali or sulphite solutions. It is one of the prime developers and used to appear in almost every formula, but it has been known to cause dermatitis and other skin problems where users have been allergic to it. It is now superceded in many ways by Phenidone which is easy to use and safer.

Oxalic acid, $(CO_2 H)_2.2H_2O$, is a white crystalline substance fairly soluble in water at room temperatures and used in the platinum printing process (page 2364). The supply is restricted because it is poisonous, and your means of storage should be an airtight bottle.

Paraphenylene diamine, $C_6H_4(NH_2)_2$, is a light brown powder, fairly soluble in water and used as developer in fine grain formulae. There may be restrictions on supply because there have been recent cases of poisoning and dermatitis. Tightly fitting jars and lids are needed. A more stable substitue is paraphenylene diamine hydrochloride, a soluble white powder that has improved keeping qualities.

Phenidone, $C_6H_5N (CH_2)_2 NHCO$, is a white crystalline powder easily dissolved in dilute alkalis but less soluble in water. It is a developing agent and due to much reduced risk and higher activitiy, it is a preferable alternative to Metol. There are no restrictions on supply or storage.

Potassium alum, $KAl(SO_4)_2.12H_2O$. Potassium aluminium sulphate is a fairly soluble colourless, crystalline material used as a hardener in fixing baths. There are no restrictions on supply or storage.

Potassium bichromate, also called potassium dichromate, $K_2Cr_2 O_7$, comes in the form of dark orange crystals that are freely soluble in hot water. It is used in bleaches, intensifiers, carbro and gum dichromate processes. There are no restrictions on supply and it is best to keep the crystals dry in an airtight jar. Ammonium bichromate is often used as a substitute.

Potassium bromide, KBr. The crystals of this substance are opalescent and shaped like small cubes; they are easily dissolved in water and find use as restrainers in bleaches and developers. There are no restrictions on supply or storage and sodium bromide is sometimes used as a substitute.

Potassium carbonate, K_2CO_3, sometimes called potash, is a soluble white powder that absorbs moisture very quickly. It is the alkali component in some developer formulae and there are no restrictions although it is somewhat corrosive and requires tightly stoppered storage.

Potassium chloroplatinite, K_2PtCl_4, is a reddish, soluble, crystalline substance that has uses in toning and platinum printing (see page 2364). Because this expensive material is a poison supplies may be restricted and dark brown glass airtight jars are needed to protect the chemical from light and moisture. It is always important to use distilled water for preparing solutions as potassium chloroplatinite is sensitive to pH changes.

Potassium ferricyanide, $K_3Fe(CN)_6$ is a toxic red crystalline chemical, easily soluble and used as a bleach. Available from photographic suppliers in airtight containers because it absorbs moisture from the air.

Potassium hydroxide, also called caustic potash or potassium hydrate, KOH, is a corrosive substance available as white pellets that dissolve easily in water. It is the alkali used in highly active developer formulae and is subject to restricted supply. It must be stored in airtight glass containers and often sodium hydroxide is used as an alternative.

Potassium iodide, KI. Soluble white crystals used in bleaches and reducers.

*Potassium oxalate, $K_2(CO_2)_2.H_2O$, consists of a freely soluble crystalline white material used in the platinum process (page 2364). It is available on restricted supply and should be stored in dark brown airtight bottles because it is sensitive to light and moisture.

Potassium permanganate, $KMnO_4$, is a violet coloured crystalline substance that is fairly easily dissolved in water at room temperature. It is used in tray cleaning formulae and reducers. Restrictions may apply in some countries as it is corrosive and flammable and should be stored in airtight glass jars.

Potassium persulphate, $K_2S_2O_8$, is a white powder that will dissolve in water on vigorous stirring and is used in reducers. There are no restrictions on supply or storage and ammonium persulphate is a popular substitute.

Silver nitrate, $AgNO_3$, is sometimes called lunar caustic and takes the form of water soluble clear crystals. It is used in the majority of emulsion preparations and in silver intensifiers. Although fairly expensive it is easily available and can be stored in glass bottles with tight fitting lids. It is a mild corrosive.

Sodium bichromate, $Na_2Cr_2O_7.2H_2O$. Red crystals very soluble in water. This is an alternative to ammonium bichromate in bleaches, carbro and gum dichromate processes; supplies are easily obtained but must be kept in airtight glass jars to keep out moisture which would quickly be absorbed. See also potassium bichromate.

Proper chemical storage *It is essential to keep raw and prepared photographic chemicals away from childrens' reach, and in a locked cabinet. This you can make for the purpose—or you may prefer to convert an existing one. It should be made of sturdy wood, with blockboard or planking rather than laminated chipboard unless this is very well supported. Polythene sheeting, enamelled metal trays and Formica/ Melamine can all be used for protection against accidental spills—which must be wiped immediately. Make sure the cabinet is level and does not rock. If placed on the floor—within reach of children—or elsewhere subject to searching eyes, fit a lock. Choose a room which is both dry and moderately cool*

Sodium bisulphite, $NaHSO_3$. A sharp smelling white powder that is fairly soluble in water and is used as a preservative in developers or for acidifying fixers; there are no restrictions on supply or storage but the vapour given off should be avoided.

Sodium bromide, $NaBr.2H_2O$, takes the form of soluble white crystals. It is used as a substitute for potassium bromide restrainer in developers and bleaches. Eight parts of crystalline sodium bromide are equivalent to seven parts of potassium bromide and there are no restrictions on supply or storage. Anhydrous sodium bromide, NaBr, is a concentrated white powder form of the above, and six parts of anhydrous sodium bromide are equivalent to seven parts of potassium bromide.

Sodium carbonate anhydrous, Na_2CO_3, is a soluble white powder used as alkali in some developer formulae.

*Sodium hydroxide, NaOH, also called caustic soda, comes in white sticks or pellets that absorb moisture strongly and are very soluble in water, releasing heat as they dissolve. It is the alkali used in some developers and restritions apply to this corrosive substance, which must be stored in tightly stoppered jars.

Storage cabinet
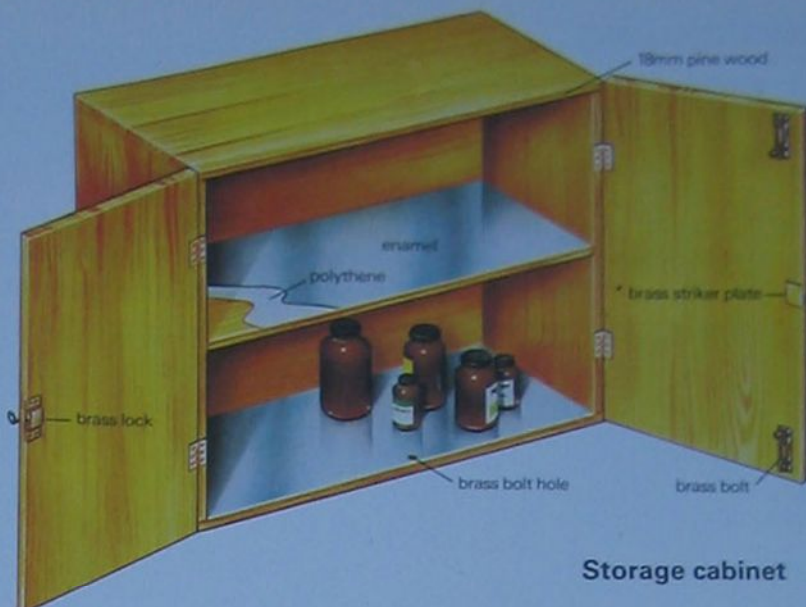
Sodium metabisulphite, $Na_2S_2O_5$, is in the form of soluble white crystals used as developer preservative or for acidifying stop and fixer baths.

Sodium metaborate, $NaBO_2.2H_2O$, is a soluble white crystalline powder used as alkali in many developers.

Sodium sulphide, $Na_2S.9H_2O$, is an opalescent crystalline substance that strongly absorbs moisture and dissolves quickly in water. It is used in toning and residual silver tests and is toxic, releasing a poisonous vapour; so restrictions may apply in some places. It should be used in well ventilated areas and kept in airtight jars.

Sodium sulphite, $Na_2SO_3.7H_2O$. White hexagonal crystals, soluble in water and used for preservative in developers. There are restrictions on supply or storage. Sodium sulphite anhydrous is also available in the form of a white powder that is twice the strength of the crystalline substance.

Stop baths.
Kodak SB1

water	1.0 litre
acetic acid	17.0 ml

Alternative stop bath hardener that changes colour when exhausted.

chromic potassium sulphate	20.0 g
water to make up to	1.0 litre

Sodium thiocyanate, also called sodium sulphocyanide, NaCNS. White crystals that absorb moisture; used in developer formulae. Poisonous and may be subject to restricted supply. Airtight storage bottles needed.

Sodium thiosulphate, $Na_2S_2O_3.5H_2O$, also called hypo. This is available as colourless hexagonal crystals that are very soluble. It is the best known fixing agent and is obtained from photographic suppliers and pharmacists. Airtight jars are needed to keep moisture out. There is also an anhydrous white powder form that is 50 per cent more concentrated.

Understanding...
HOW A LENS IS MADE

In these days of electronic wizardry, it is surprising to find that lenses have been made in virtually the same way for centuries. Though tolerances are higher, glass is still worked to the correct shape by grinding with abrasives
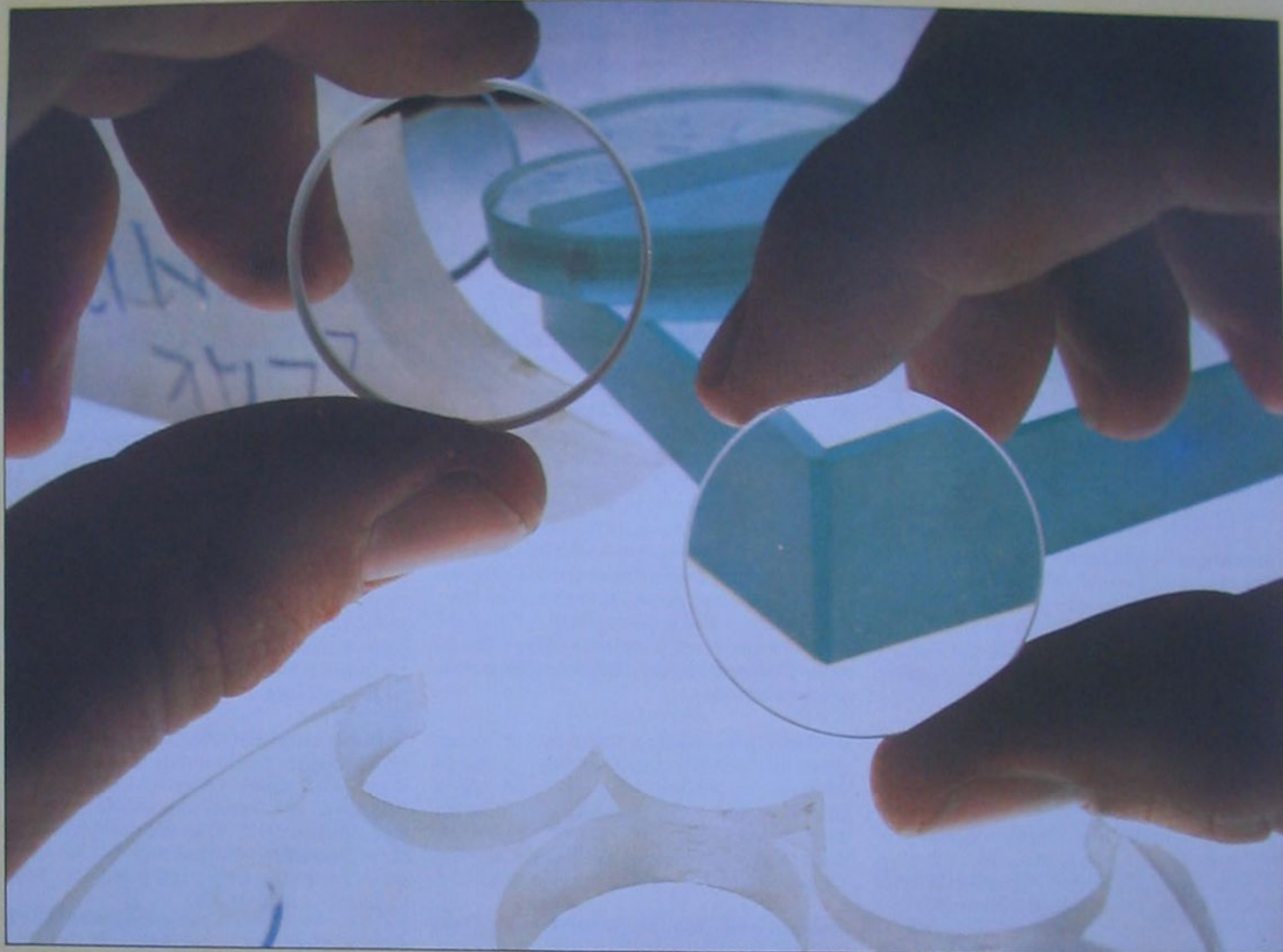
Although the techniques of anti-reflection coating and lens design have been revolutionized in recent years, lens production methods have remained virtually unchanged since the earliest days. Computers are used to control some processes, but the final polishing and testing demand a skilled technician's control.

For lenses made in large numbers, the blanks may be moulded to near the required diameter and surface curve, but some truing up is needed with a diamond generator. Glass can be machined on a conventional milling machine, except that the cutter is a wheel impregnated with fine diamonds. To

the human touch it feels harmless enough, but spinning at several thousand rpm it will cut glass rapidly.

After this preparation, the glass has the correct curve on both sides, but is covered in a fine spiral of ridges from the milling cutter. These must be removed by the next process which is called *smoothing* or fine grinding. This is done by sticking a number of lenses on a 'block' of the required curve, and rubbing them to and fro on a cast iron tool with a mating curve. The grinding medium is an abrasive such as aluminium oxide or garnet powder mixed with water.

Lenses which have finished this process have a fine silky surface covered in tiny pits

from the abrasive, and are accurately spherical. This is because two surfaces—such as the block of lenses and its tool—rubbed together long enough will fit intimately. Two flats or two sections of a sphere are the only shapes which fit together when their centres are displaced. This is the main reason why nearly all camera lenses have spherical surfaces, since an aspheric design calls for individual, and hence expensive, treatment.

The same principle is employed in the polishing process. The iron tool is replaced by a polisher made of pitch, a very viscous material refined from pine trees. The polishing medium

Blanks *The glass blanks from which these lenses were made are cut from larger discs and slabs of optical glass which is free from defects and bubbles*

is powdered cerium oxide, a rare earth. Pitch flows slightly, which helps it conform to the glass curve, and gives the finest polish yet known. The micro-ripples on a pitch-polished surface may only be 10 angstroms high (about 1/500 the wavelength of light), whereas other methods produce surfaces far inferior to this. This extreme quality can as yet be produced only by skilled polishing by hand; machine polishes are generally at least four times worse. The

polishing process itself is still something of a mystery. Certainly, it is a micro-abrasive process, some chemical etching takes place, and equally certainly the glass flows on a minute scale. Which of these factors is dominant is uncertain.

The lenses on the block are tested by interference. Mechanical methods are not satisfactory since the lens surfaces have to be spherical to a wavelength of light to perform well. An accurately made master curve (the *test plate*) is placed in contact with one of the lenses and illuminated by monochromatic light (generally mercury vapour or sodium).

Interference fringes (Newton's rings—see page 2066) are seen between the lens and test plate according to how well the two surfaces fit—the fewer fringes seen, the closer the fit. These fringes are the same phenomenon as the rings sometimes seen between the glasses of slide mounts and illustrate the wave nature of light. Each fringe indicates an air gap of half wavelength of light between the surfaces. The tolerated departure from the test plate varies according to the design and manufacture, but about two to five circular fringes is typical. This implies a tolerance of only 0.0005 mm for the best lenses. In addition, the better makers would reject any lenses which showed oval or triangular fringes as these would produce astigmatism in the final image. To avoid such astigmatism requires even higher degrees of accuracy. Precision such as this, achieved with very simple equipment, makes normal engineering tolerances seem rather sloppy.

When the first sides of the lenses are finished they are taken off the block and turned over to polish the reverse sides. The number of lenses which can be fitted on to a block has a direct bearing on the price of the product. Steeply curved lenses have to be polished individually, since a block of them would be more than a hemisphere, and unmanageable for machine work. This extra expense is a challenge to designers who also try to avoid very thin lenses which may distort on polishing.
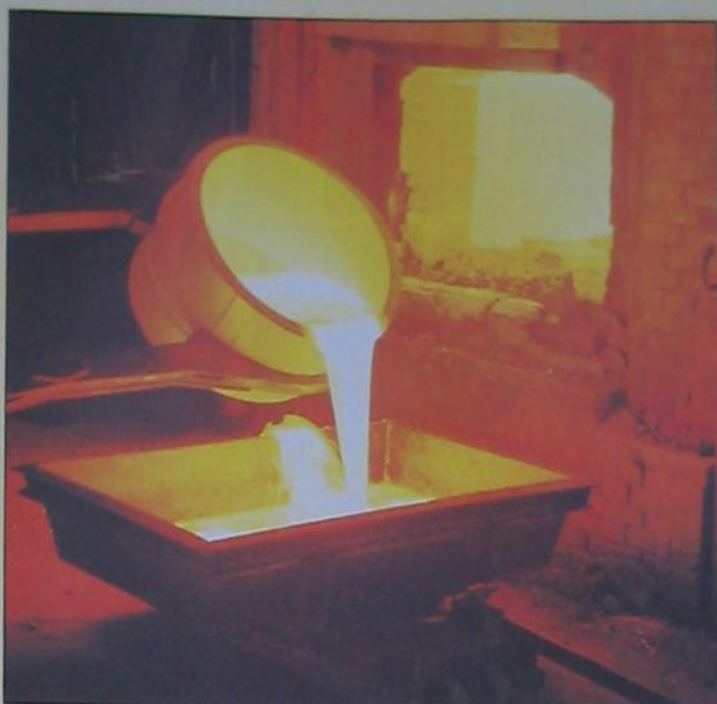
Molten glass *Optical glass contains a complex mixture of trace elements. Cooling must be monitored with great care, to avoid internal stress, bubbles and impurities. This is essential because the refractive index of the glass used affects the calculated focal length and performance of the final lens*

Carl Zeiss-Jena Ltd

Polishing machine *The tool on the right fits over the block of lenses, in this case concave ones. The arm moves the tool to and fro every second or so, while the turntable rotates a few times each minute. A solution of abrasive or polishing powder between tool and blank grinds the glass to a spherical surface*

Dave King
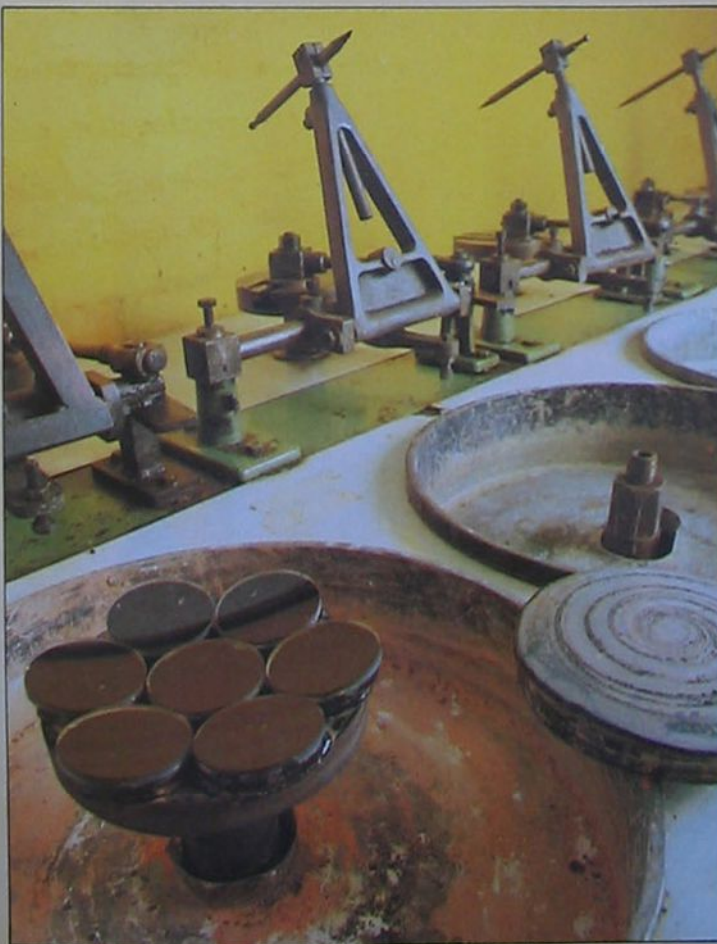
The fully polished and tested elements are then rigorously inspected for surface blemishes and the remains of smoothing pits. Fine scratches on a lens contribute to flare in the final image, and would not be allowed unless very minor indeed. The edges of each element are then milled to ensure that the optical centre of the element can be precisely located in the centre of the barrel in which it is mounted.

At this stage, any elements which appear in groups are cemented together. Any errors in this department could produce colour fringing in the final image due to a wedge effect between the elements, like a prism. After this, the lenses are multi-coated under conditions of extreme cleanliness, edge-blackened to prevent internal reflections, and assembled in their mounts. Finally the completed lens is tested to see if it meets its specification. This may be done in a variety of ways, but one standard technique is to use the lens in reverse to project an image of a test target which is then examined for defects.

In view of the close tolerances required, the problems of pitch flowing and various heat problems, optical lens production may never be entirely automated. The greatest strides in efficiency have come in the preparations stages. Computer controlled machinery reduces the waste of glass to a minimum. The latest generation of milling machines can produce surfaces fine enough to polish without smoothing, and techniques are now available to polish lenses to a rough shape within minutes rather than hours. Advances are being made in the USA and Europe in single point diamond turning and computer controlled polishing, which may have an impact in the production of new lens designs using aspheric components. The cost, uniqueness, and hence limited usefulness of this machinery is such that it is presently being used largely in military applications. For the near future, lens production will remain based on traditional methods, helped along by better machinery, inspection and techniques.

World of photography
ANTHONY EDGEWORTH

Anthony Edgeworth took up photography as a career relatively late in life, but this has not prevented him from rising to the peak of his profession

New York photographer Anthony Edgeworth's pictures are often strikingly clear and direct, but his route into the profession was anything but direct. After leaving college, he followed a string of different careers including the army, acting, stock-broking, selling men's wear and finally working as an executive in a New York fashion house. Then suddenly, when he was 34, Edgeworth felt a compelling urge to accomplish something much more worthwhile. There was absolutely no doubt what this should be—photography seemed the only possible choice.

Photography had appealed to Edgeworth at an early age, but as with his acting and college hopes he had never had the incentive to see things through. This general lack of direction he attributes to the 'flippancy of youth'. Once he had finally decided that he really wanted to accomplish something for himself he went about his new career in a very deliberate manner.

In 1969, Edgeworth started attending a photography course at the New York School of Visual Arts, and the following year he approached some top New York photographers to work as an assistant. Among the big names Edgeworth went to see was Pete Turner who seemed to be impressed by Edgeworth's determination to succeed at such a relatively late age. He took Edgeworth on. Just over a year as Turner's assistant taught Edgeworth all about lighting and showed him how to tackle a wide range of assignments. Just as vital, they taught him how to run a business and a studio.

Turner always discourages his assistants from staying around for too long—a policy that Edgeworth has continued with his own employees. So after 14 months, Edgeworth went to work for himself. The most important thing for his future success was to put together an impressive portfolio. His ambition had been to work as a travel photographer, so an invitation to join a safari in Africa seemed an excellent starting point. Subsequent trips to Russia and England added to his stock material and gradually Edgeworth started to assemble a folio. This he felt contained the sort of photographs that would attract potential clients.

This prolonged trip also gave Edgeworth his first major assignment—for *Esquire* magazine. *Esquire's* editor had met Edgeworth while he was still working at Turner's studio and had been so impressed by his determination to succeed in photography that Edgeworth was assigned to photograph the Household Guards and their tailors in London. The assignment was a success

Gloved hands *This close-up of a Welsh Guards officer was shot using daylight to give rich, natural colour*

Portrait *Edgeworth spotted this Life Guards Lieutenant riding in Hyde Park and arranged a portrait session*

Brasilia cityscape *This ultra-wide angle juxtaposition was taken on a shoot for a South American airline*

and Edgeworth was offered many more *Esquire* features as well as work for other top American magazines. 'It may sound a bit flip but that's how things started', Edgeworth explains. 'I did one good job and that led to another. I never looked back.'

The Household Division feature had a further significance for Edgeworth. The subject so interested him that it became a long term project which, eight years later, resulted in the publication of Edgeworth's first book, 'The Guards'. This lavish publication represents the

sort of work that Edgeworth likes to do best—where excellence is the sole aim and where he himself has complete control over which photographs are used and how they are laid out. The book allowed Edgeworth to place his seal on the whole project, his own individuality.

This was in contrast with his magazine work where the editor and designer have ultimate control over how his pictures are used. It did not take too many magazine features before Edgeworth started to get disillusioned with the editorial market. 'You want to work for a magazine and you do a good job for them. But the next thing you find is that after all the work you put in, the layout looks awful, they misspell your

name, they use the wrong pictures—and at the end of it all you realize you haven't made any money out of it.'

However, having established himself as one of the top American photographers, Edgeworth now finds himself in a position where he can edit the work a little more carefully sending the editors a very select range of photographs. In this way he is able to ensure that only his very best work is published.

Magazines are still important to Edgeworth and he still does travel stories for publications such as *Geo*, but he only takes on stories if he feels that they will allow him to do his best work.

At the outset of his career, Edgeworth had to take any job he could get—colour
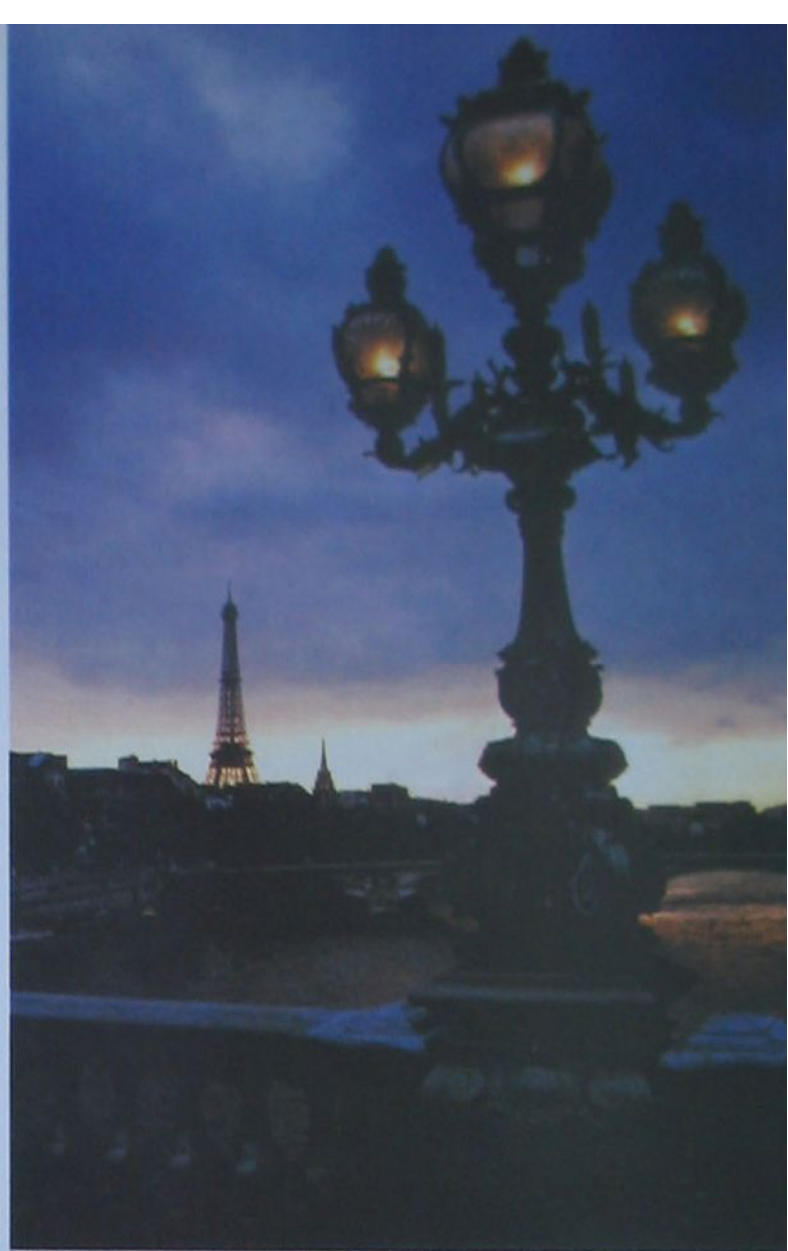
Paris river scene *A three month visit to Europe allowed Edgeworth to shoot photographs for his own stock*

Eiffel Tower *To get some atmospheric shots of Paris, Edgeworth went out before dawn on a rainy day*
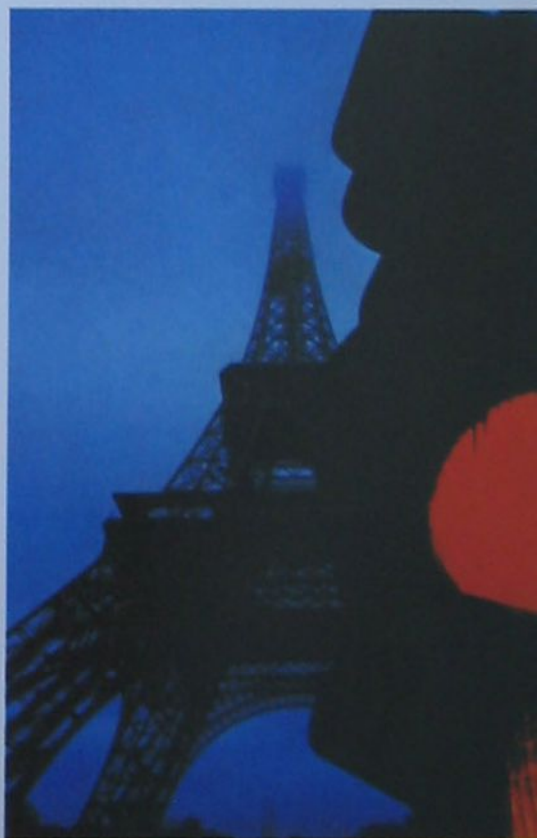
or black and white—just to keep the money coming in and to cover the expense of running his New York studio. However, after working for a while solely for magazines and some corporate clients, Edgeworth managed to break his way into the world of advertising. 'This step is always difficult' he explained. 'To get advertising work you need to have advertising tear sheets (sheets of published work)—it's another viscious circle.' However he managed to break into this circle, and soon found that he was earning very well indeed. 'Advertising work tends to be more fun when it pays well.'

Nevertheless, Edgeworth still retains his love of travel photography—recently he went off on another three month trip with his assistant. Although he did some magazine assignments while he was away, he planned the trip mainly to shoot personal work. Stock pictures are very important to him and he is always building up his supply, but he lets the Image Bank agency handle them for him. He also has an agent in New York who shows his portfolio around and keeps a flow of commercial assignments coming in. In spite of this help it is still a problem for him to find the time to organise his studio and edit his stock shots as well as actually taking the photographs.

As a former assistant of Pete Turner, Edgeworth might be expected to use special effects or a duplicating process

Anthony Edgeworth

have to make them work. Everything is set up before a session so that there is no fiddling about with lighting or backgrounds during it. The model or personality then stands in and I try to keep them amused for a few rolls' During a session Edgeworth tries to create images that capture a natural, spontaneous feeling. The enormous amount of pre-planning that has taken place will have prepared the ground.

Clients come to Edgeworth mainly for the clean, graphic images he produces —even with portraits, where the cleanness and negative space he creates suit the art director's requirements. 'I feel that my work is unique. There may be some people around doing something a little bit similiar, but I feel my work has a certain quality and taste.' This taste is probably shown most graphically in his book. The richness of colour, the soft natural light, the balanced compositions and the substantial, orderly nature of the subject itself all work together to create

to alter his final images in the same way as Turner, but this is not the case.

'Turner taught me all about lighting, but I never really wanted to imitate his most unusual techiques. I shoot reality all the time. To improve on this I try to find prettier people and better locations, more animation or more control over whatever or whoever I am photographing'.

For someone who does a lot of advertising work and spends nearly half of his time shooting in the studio, it comes as something of a surprise to learn that Edgeworth uses 35 mm equipment exclusively. This is even true of the shots that are to be blown up to billboard size or to long narrow posters fitted to the sides of buses. He finds that the combination of Nikon optics and Kodachrome 25 film always give him the quality he needs—and always satisfies

Doorway *On a trip through the Arran Islands on assignment, Edgeworth took a number of personal shots of local details*

Landscape *The heavy clouds of a thunderstorm invested this Burgundy landscape with drama*

his clients. 'I never use Kodachrome 64— it always looks terrible to me. I used to shoot a few rolls as well as the Kodachrome 25, but I always ended up throwing it away—it has more contrast and tends to redden the flesh tones.'

His commercial work mainly consists of photographing people—either using flash, or whenever possible, using daylight. Often the people who come to his studio to be photographed are celebrities who do not want to be kept waiting. 'The main thing is to make people feel comfortable, but you also

Italian street *On his way to Tuscany to shoot a story for 'Geo', Edgeworth was attracted to the town of Carrera*

the exquisite style which is identified with his work.

In a short time Edgeworth has learned all about photography, cultivated editorial, corporate and advertising clients, has photographed and produced his own book and established himself at the top of his profession. But even after this meteoric rise, a photographer still has to work hard to stay ahead of the competition so as to be able to continue with the work he loves. More plans for books are already being made and Edgeworth's ambition to be a travel photographer will always lure him away from his studio. Being more and more in control of what he shoots and the way it is used is something that few professionals can look forward to, but Edgeworth has already reached this point, another stage in his rapid passage to success.

Print fading test

Colour prints fade even under ideal conditions, but the extent and rate of fading varies from print to print—so we conducted a long term trial to see which best stood the test of time

It is generally agreed that nothing is everlasting, but many photographers could be forgiven for believing their colour prints will last at least a few decades. Indeed, the lifetime of colour prints is far longer than it was a decade ago, due to improvements in manufacture and processing although b & w prints are still the most durable. But if you wish to preserve an image in colour, you should consider just how temporary the medium is.

Essentially, the image of a colour print is stored in layers of coloured dyes superimposed so they give an illusion of several colours. These dyes fade naturally, as do all dyes, depending on how they were formed and the conditions under which they are stored. But there are at least five processes for making colour prints, and each gives a print of different duration.

Colour print processes

In the photographic trade the most popular type of print is called a *C-type* or

Steve Mansfield

Cibachrome *Despite noticeable fading and bleached highlights (right above) the Cibachrome fared better under test conditions than the other print types. The original is shown on the left*

Roof test *To test the extent of fading, each of the test prints was mounted in a glazed frame and positioned on the roof*

C-print. These are the standard photographic prints made from a negative or from a negative made from a slide (an internegative). They are simple to make, either by machine or using an enlarger, and are successful as long as the negative or internegative is of good quality. C-types are made on resin coated (RC) paper only, and are inexpensive.

R-type or reversal prints are made by the direct reversal process, from colour slides. There are two main systems: Ektachrome and Agfachrome. These R-types are available on RC paper only, and are somewhat more expensive than C-types.

Cibachrome prints are a kind of R-type which are generally regarded separately. They are made directly from colour slides, using conventional silver processing, and are available on either RC or white polyester base.

The dye transfer process for making prints dates back about 50 years, but it is extremely tedious and expensive (see

page 1884). For these reasons, it is little used, even though the durability of its prints is often better than that of Cibachrome.

The latest print processes, Ektaflex and Agfachrome Rapid, are also dye transfer systems of a sort, but have not been available long enough for their characteristics to become known.

Prints made by instant cameras, such as Polaroid and Kodamatics, are yet another category. Polaroid's SX-70, for example, employs preformed dyes, as in Cibachrome. To form an image, the dyes migrate across the layers. Migration can continue slowly over many years and cause the image to deteriorate.

Of the four common print processes, Cibachrome gives the most stable colour prints. The reason for this lies in the way the image is formed. Cibachrome employs a dye–bleach technique in which dyes incorporated into the paper emulsion are bleached away to leave the image. The dyes are durable because they are azo dyes which are more stable than the dyes produced by colour development. The dyes in C-type and R-type prints are much less stable.

Types of fading

The rate at which a print fades can be reduced drastically by refrigeration. Usually, this has the added advantage of shielding the print from light, which usually accelerates fading. For the purposes of most amateurs, however, refrigeration or storage in the dark is expensive and inconvenient. Moreover, storage in the dark is no guard against fading. Indeed, dark fading is unavoidable, and is distinct from light fading. In dark fading, the cyan, magenta and yellow dyes fade at different rates, so fading appears as a shift in colour, which can usually be compensated for by filtration during reprinting. Light fading is more destructive. It is a degradation of the highlights of the print and cannot be rectified. And both refrigeration and dark storage are impractical if prints are to be displayed continuously, such as in a gallery or in advertising.

Instead of refrigerating the prints, you could more conveniently refrigerate valuable negatives, and make fresh prints when the old ones have faded. Refrigerated negatives will last several decades, but under normal indoor storage conditions fade within a few years. Ektachrome slides are expected to last 50 years and Kodachrome 100 years under similar conditions. Stored under ideal conditions, Kodachrome would have an even longer life and could be used to make successive reprints on
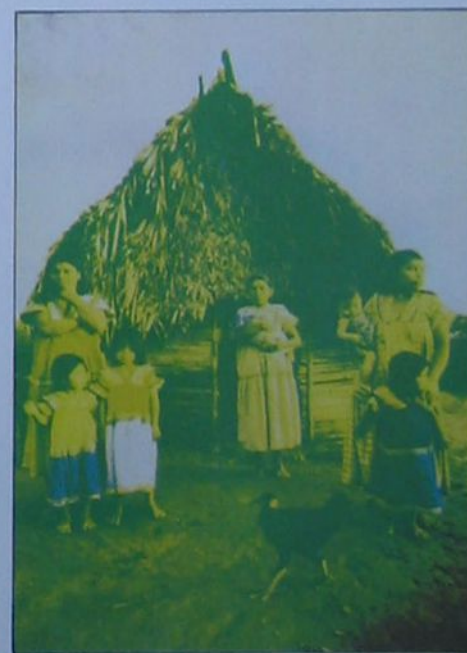
Kodak R-type (top) On this print, fading (right) produced an image almost entirely yellow and blue.
Agfa R-types Fading here produced a virtually colourless image, but some detail was still retained in the clouds. There was very little difference between the commercially produced print (middle), and the home produced print (below)

Mike Goldwater/Network

2663
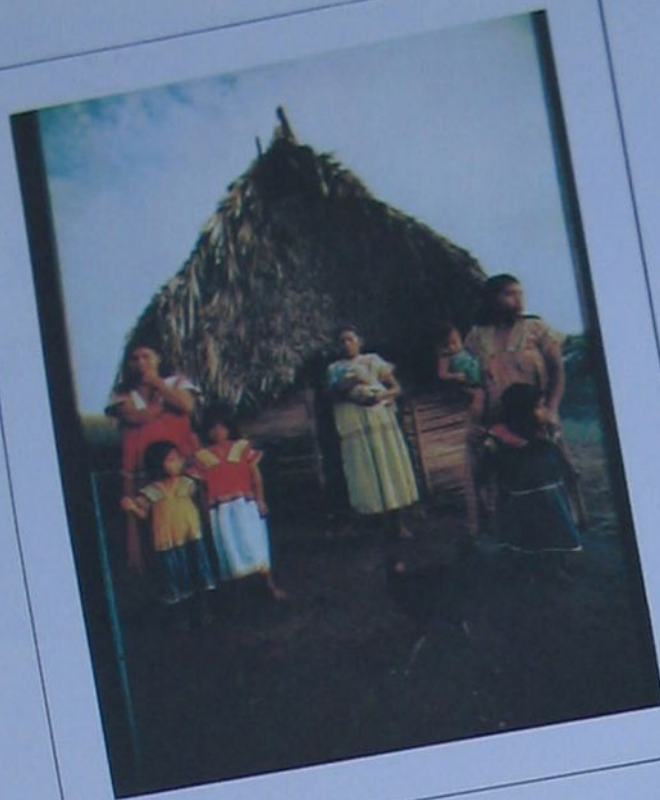
Polaroid *Despite the poor quality of the original some colour was retained after the fading test. The most serious loss of colour was in the yellow areas*

Cibachrome—giving great longevity.

If prints are stored at temperatures and light levels higher than those usual indoors, then fading will be accelerated greatly. Even indoors, direct sunlight can provide these conditions, and outdoors on a wall or hoarding, for example, conditions can be extreme. The dyes are faded by radiation from the visible spectrum and infrared (heat), but also from the ultraviolet (UV). Much of the UV is absorbed when sunlight passes through glass, so fading is less severe on prints exposed to sunlight indoors.

Special lacquer is also available for coating prints. This will shield the print from some of the UV, as will the glass or plastic of a glazed frame, but will not offer any protection against other wavelengths. Sunlight in general is harmful and fading is not caused specifically by the UV end of the spectrum. In fact, resin coated print materials are actually more likely to suffer from image dicoloration and fading when exposed to sunlight if they are mounted behind glass.

Prints fade more quickly in humid atmospheres, because water vapour destabilizes the print material by chemical action. Attention to humidity is particularly important in polluted atmospheres, because pollutants also tend to accelerate the rate of fading. Water vapour tends to activate the pollutants, so they are most effective in moist conditions. Wide variations in humidity can also cause the plastic surface of an instant print to deteriorate and lead to fading. If you are storing prints, it is important to keep both the temperature and the humidity fairly constant. A temperature of 21°C and a relaltive humidity of 15 to 40 per cent will reduce fading in prints which are to be stored for archival purposes. However, in exhibitions and displays it may be difficult to keep temperature and humidity at a constant level.

Colour stability test

It is generally known that of all the various types of print, Cibachrome is most durable (dye transfer is equally good) followed by instant prints, R-types and C-types. What is not so well known, however, is how much difference there is between these prints and how much they fade under extreme conditions. We therefore arranged a limited test that would give conclusive results over a period of a year.

A Kodachrome transparency with a range of bright and varied colours was taken specially and from it were

Agfa C-type *(left) Fading here was extreme, producing a print that showed virtually no image at all, and no colour*
Kodak C-type *(right) Although slightly less faded than the Agfa C-type, the effects were still extreme*
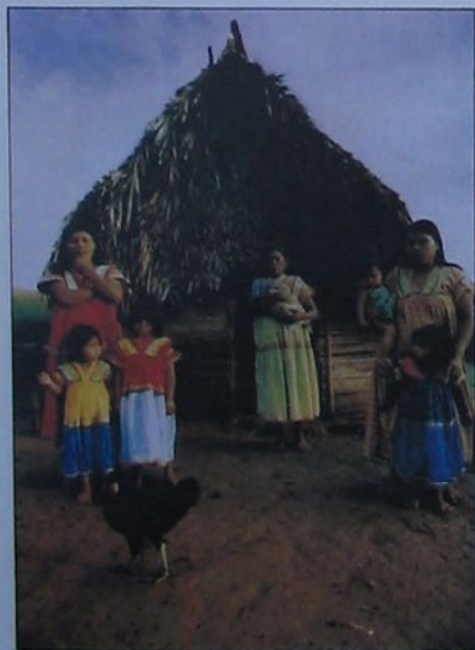
prepared commercially two prints each of Kodak and Agfa R-types, Kodak and Agfa C-types (using an internegative), and Cibachrome. In addition, another two prints were prepared in our darkroom and included in the test, a long with Polaroid prints made using a Polaprint machine. One of each print type was stored in the dark at room temperature, and the others were pinned inside a glazed frame, which was positioned on a roof so that the prints were in sunshine for most of the day.

To absorb moisture and control humidity, two 500 g bags of silica gel were placed inside the frame. The test commenced on 2 November, and the prints were examined frequently. During cold or wet conditions, the silica gel was removed and warmed on a radiator to expel moisture.

The results

Four months after the test commenced, there was strong evidence of fading on R-type and C-type prints, and four months later there was little colour left in the C-types. After a total of 10 months on test, we removed and compared the prints with the controls.

As expected, the Cibachrome was most long lived. Although it had faded noticeably, the print retained much of its richness, though showing bleaching of highlights. The sky was largely bleached out, with only a vague suggestion remaining in the darkest areas.

As a very poor second came the Polaroid, which retained some sugges-tion of the original colours, but appeared badly stained due to migration of dyes within the print material. Next came the Agfa and Kodak R-types, which were barely recognizable as colour prints. Darker areas of the prints had developed a strong blue cast, dark blues had turned dark grey and bright reds to muddy yellow, bordering on to grey. There was little difference between commercially processed R-types and those processed in our darkroom.

Agfa and Kodak C-types were totally devoid of colour. In fact, the Agfa print showed only a faint outline, much like the ghosting on a poorly received television image, and the Kodak print was only slightly better. By any standard, these no longer showed a photographic image.

To a certain extent, the results reflected the quality of the original prints. The Cibachrome was the closest rendering of the transparency, followed by the Kodak R-type and C-type, the Agfa R-type and C-type and the Polaroid. Nevertheless, the results showed conclusively that Cibachrome was by far the superior print material. No attempt was made to assess the extent of dark fading scientifically, but after 10 months there was no obvious change in any of them.

For prints displayed under normal conditions indoors, this test measures only the relative fading of the different types of print, but not the rate at which each would fade. To measure the absolute rate of fade, you need to determine the rate at which the cyan, magenta and yellow dyes fade. And significant changes could be detected only if the test were conducted over a long period of time, or speeded up by exposing the prints to sunlight or simulated sunlight. The results of any accelerated test can be useful only if the results can be correlated with real time fading.

Also, there is the problem of reciprocity failure when conducting accelerated tests (see page 446). Short bursts of high intensity illumination carried out in test conditions will not cause as much fading in colour print materials as long exposures to normal indoor lighting conditions. This is a factor which has been largely over-looked in the past by manufacturers when carrying out fading tests.

If you display prints outdoors, the test is an accurate guide to choosing between the different print processes, but a longer test period would be required to determine the durability of Cibachrome. Under dark storage Cibachrome will last far longer than other colour print materials, and show virtually no fading at all. However, under normal lighting conditions fading is still dramatic when compared to that of a well preserved black and white print. It is possible that a truly permanent colour print process will eventually become available, but until then prints remain only a temporary means of storing coloured images. So if you want to retain an image indefinitely, you should always look after the negative.
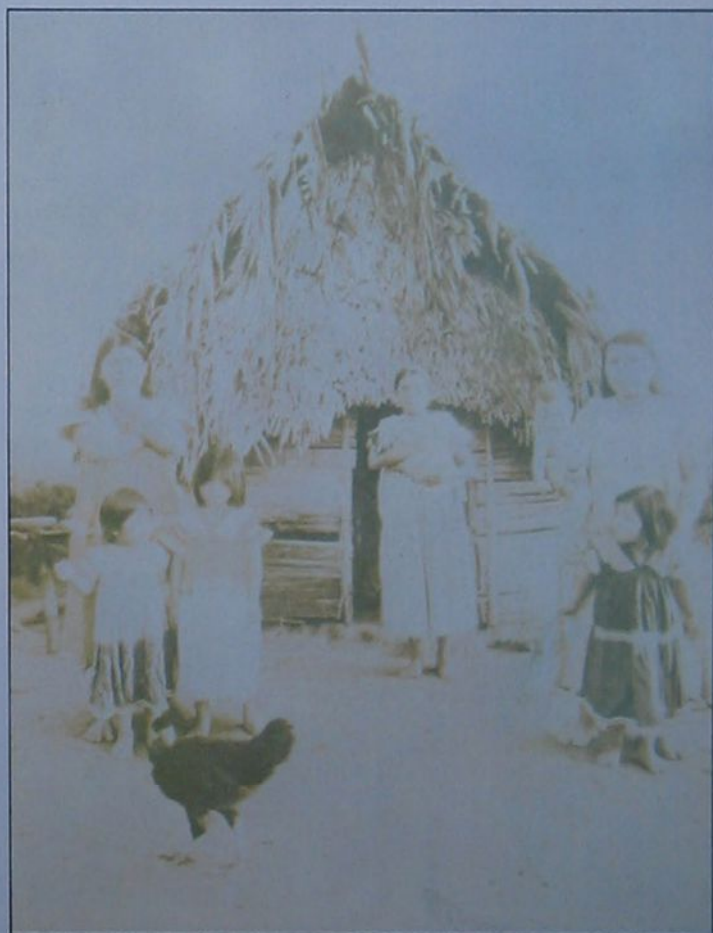
DATA FILTERS

Choosing the right filter can be difficult. So to help you, here is a list of all the most important ones, and tables showing how some of them can be used

Many problems in photography can be overcome by the use of suitable coloured filters. And even simple filters can be used creatively to turn an ordinary shot into something worthwhile. As well as special effects filters, there are the straightforward gelatin filters, which are less often mentioned in catalogues. It is useful to know what types there are.

These pages provide a list of most of the filters available in gelatin form, which is the most versatile and wide ranging type. The numbers in the main list refer to the Kodak Wratten number, though the same numbers are used by most other manufacturers too. The filters in each section are listed in order of their density. The additional tables suggest ways of using some of these filters to correct for artificial lighting, and the final one shows exposure increases for a range of colour compensating filters, which are used to 'fine tune' colour temperature.

Ed Buziak
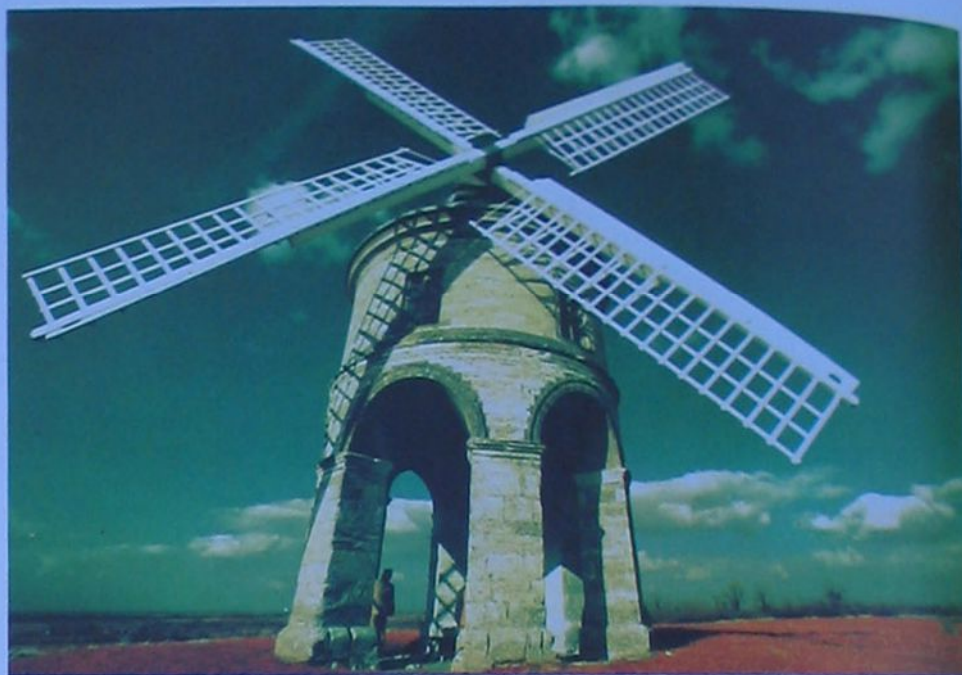
Pink

1A Pale pink These filters, often called *skylight* filters, are used to absorb excess UV radiation. For general photography they are of comparatively little use. However, they do have some effect in reducing the blueness caused by haze at high altitudes. They are also occasionally useful when there is a great deal of UV, such as a snow covered landscape under a blue sky, though an 81A is often better. The glass in modern lens elements usually filters out a sufficient amount of UV, though some photographers use glass versions of this filter as protection for their lenses, in place of the more usual UV types.

Yellows

Yellow filters also absorb ultraviolet radiation. They are sometimes used to filter for haze, particularly in black and white work, and are popular for aerial photography. They are also used to darken blue skies, and increase contrast with black and white film. The darker yellow filters are used with colour infrared (false colour) film to prevent the result being too blue.

2A Pale yellow Absorbs UV below 405 nm. Used to reduce haze at high altitudes
2B Pale yellow Absorbs UV below 390 nm. Better than 2A at reducing haze
2E Pale yellow Absorbs UV below 415 nm. Like the 2B but has more effect on UV
3 Light yellow Often used in aerial photography to correct for excess blue
8 Yellow Gives correct rendition of sky and foliage on black and white film
9 Deep yellow Similar to No. 8, but gives a stronger, more dramatic effect
11 Yellow–green Gives correct rendering in tungsten light on monochrome film
12 Deep yellow Used for haze penetration in aerial photography and for monochrome infrared materials
15 Deep yellow This produces even more dramatic effects than No. 8 or No. 9. It is used for black and white copying of documents on yellowed paper. It is also used for infrared and fluorescence photography

Oranges and reds

These filters are designed to absorb ultraviolet and blue, and also varying amounts of green. With black and white film they are used to increase contrast—for example, to darken blue skies, bring out the grain in wood, or pick out the detail in brick. Red filters are also used for technical work, such as colour separation, colour printing and two-colour photography. The last is a method of producing colour pictures by breaking down the image into two colour components.

16 Yellow–orange filters are mostly used for emphasizing detail in wood and brick, and also widely used for darkening blue skies, in both cases using black and white materials
21 Orange is the most popular orange filter, used to give greater contrast on black and white film
22 Deep orange Commonly used in photomicrography with blue preparations, this filter has greater green absorption than the other orange types
23A Light red Used in colour separation work and also for increased contrast with black and white film
24 Red is used mostly for two-colour photography in conjunction with a 57 (green) filter
25 Red One of the most useful red filters, the 25 reduces haze in black and white aerial shots and filters out excess blue light for monochrome infrared work. It is also used for colour separation and tricolour printing
29 Deep red Principally used for colour separation and tricolour printing

Magentas and violets

These filters principally absorb green, and are mostly used for technical applications, such as reproduction processes and photomicrography. Other magenta filters (CC filters) are used to correct for fluorescent light.

30 Light magenta Used in photo-micrography to give increased contrast particularly with green subjects.
32 Magenta Used to subtract green
33 Magenta absorbs green strongly and is used in colour reproduction processes to produce masks.
34 Deep violet Contrast filter
35 Purple The main use for this filter is to provide contrast in photomicrography. It provides total green absorption and also absorbs some blue and red

Greens

These are mostly used for black and white photography as contrast filters (to lighten foliage for example) and in technical processes such as colour reproduction and colour printing.

54 Deep green This contrast filter absorbs nearly all red and blue light, and a little green light
57 Green Used for two-colour photography with a red (24) filter
58 Green Used as a contrast filter in photomicrography and also for colour separation and tricolour printing
61 Deep green Used for colour separation and tricolour printing work with red (29) and blue (47) filters

Blues and blue–greens

These filters are designed mainly for colour separation work, tricolour printing, contrast effects in photomicrography, and to heighten contrast in black and white work. Blue conversion and light balancing filters are dealt with in a separate section. On black and white film blue filters darken reds. By emphasizing blue tones they can be used to exaggerate mist or fog.

38 Light blue is useful in tungsten lighting with black and white film to prevent red tones from reproducing too light
38A Blue absorbs a large amount of red light, plus a certain amount of ultraviolet and green
44 Light blue–green filters out red and ultraviolet
44A Light blue–green subtracts red
45 Blue–green Mostly used in photomicrography, this contrast filter is designed to absorb ultraviolet and red
47 Blue is the filter used to give contrast effects with monochrome film. Also used for colour separation
47B Deep blue This filter is intended mainly for use in colour separation and tricolour printing
50 Deep blue is a monochromat filter (see *narrow band* filters) which transmits the mercury line at 436 nm, and lines at 398, 405 and 408 nm

Narrow band

These are *monochromat* filters which transmit very small parts of the spectrum (see pages 2022 to 2023). As a result, they are very dense and are only used for technical purposes. The most common use for narrow-band, or *narrow cut* filters is in colour separation work, particularly when the separation negatives are being made from transparencies or negatives.

70 Dark red This is used in colour separation work to produce separation positives from colour negatives. It is also used when making colour prints with the tricolour printing method
72B Dark orange–yellow
74 Dark green This transmits only 10 per cent of green light and filters out practically all yellow light from mercury-vapour lamps. This gives monochromatic green light which is useful in experimental optical work as the principal focus, in lenses corrected for one colour, is computed for green light
75 Dark blue–green

Filtering for effect The *windmill shot was taken on colour infrared film. If no filtration is used this film tends to give results which are very blue. You can use a variety of filters to cut down the amount of blue light, including yellow, orange, red and opaque types. In this case an orange filter was used. The black and white shot was taken on normal film, but a red filter was used to darken the sky and generally increase contrast, producing this dramatic effect*

Conversion

These filters are used to convert daylight to tungsten, or vice versa. They are most commonly used on the camera lens, but they can be used over lights. For example, some photographers use the blue (80) filter over tungsten lights so that they can use them with daylight and daylight film (see picture on page 2598). Use of these filters is dealt with separately.

80 series, blue These are used with daylight film in tungsten lighting. The complete range is: 80A, 80B, 80C
85 series, amber These are used with tungsten film in daylight. The complete range is: 85, 85B, 85BN6, 85C, 85N3, 85N6, 85N9 (includes 0.9 neutral density)

Light balancing

These are paler versions of the conversion filters, and are designed to modify colour temperature for minor corrections. They are nearly always placed over the camera lens. You can use them with conversion filters to give full correction for light sources such as domestic bulbs (see separate table) or to give slight overcorrection for creative effect.

81 series, pale amber These slightly lower the colour temperature. The range is: 81, 81A, 81B, 81C, 81D, 81EF
82 series, pale blue These slightly raise the effective colour temperature. The range is: 82, 82A, 82B, 82C

Balancing colour

If the colour temperature of a light source is 3200K or 3400K then you can use an 80 series filter with daylight film or, in the case of the latter figure, tungsten film. But it is rare that the light is exactly the right colour, so the table below shows you what extra filtration is needed to bring the colour to the above figures.

3200K from	3400K from	Filter	Exposure increase in stops
2490K	2610K	82C + 82C	1½
2570K	2700K	82C + 82B	1½
2650K	2780K	82C + 82A	1
2720K	2870K	82C + 82	1
2800K	2950K	82C	⅔
2900K	3060K	82B	⅔
3000K	3180K	82A	⅓
3100K	3290K	82	⅓
3300K	3510K	81	⅓
3400K	3630K	81A	⅓
3500K	3740K	81B	⅓
3600K	3850K	81C	⅔
3850K	4140K	81EF	⅔

Miscellaneous

These are filters which do not fit into any of the other categories. They are all intended for various technical applications but are worth knowing about in case you ever come across them.

87 Visually opaque There are two versions of this filter—87 and 87C. Their main use is for infrared work as they absorb all visible light but transmit infrared radiation. This means that the exposure is achieved solely with infrared which is useful for analytical work. And for creative photography it means that the strange effects caused by infrared are even more dramatic
88A Visually opaque Similar to the 87
89B Visually opaque This is also used for infrared photography, particularly aerial work. It transmits radiation of wavelengths between 700 and 800 nm
90 Dark greyish amber This filter is meant for visual use, not for taking pictures with. Looking through the filter, the view is monochromatic and this gives you an idea of how the tones and colours will reproduce on black and white film
92 Red This is used, with 93 and 94, to take densitometer readings of colour films and papers
93 Green Used, with 92 and 94, to take densitometer readings of colour films and papers
94 Blue Used, with 92 and 93, to take densitometer readings from colour films and papers
96 Neutral density See separate table
98 Blue Equivalent to a 47B plus a 2B. Used in colour separation work and tricolour printing
99 Green Equivalent to a 61 plus a 16. Used in colour separation work and tricolour printing

Warm tones *When using flash, the skin tones tend to reproduce slightly too cold. You can produce a much warmer and healthier effect by using an 81A (below)*

Light balance *If you want to have the controllability of tungsten lights but prefer to use daylight film you will have to use an 80 series filter (right)*

Wayne Günther

Fluorescent conversion

This table shows the filtration and exposure increase necessary to get acceptable results with different types of fluorescent tube. It is based on Kodak films, but with a little experimentation you can adapt it for other makes. In any case, the figures are only intended as a guide, and for critical results you should always make tests.

Type of tube	Daylight films Neg. films, Ektachrome 200 and Kodachrome 25	Ektachrome 64 and 400, Kodachrome 64	Tungsten films
Daylight	40M + 40Y + 1 stop	50M + 50Y + 1½ stops	85B + 40M + 30Y + 1²/₃ stops
White	20C + 30M + 1 stop	40M + ²/₃ stop	60M + 40Y + 1²/₃ stops
Warm white	40C + 40M + 1½ stops	20C + 40M + 1 stop	50M + 40Y + 1 stop
Warm white deluxe	60C + 30M + 2 stops	60C + 30M + 2 stops	10M + 10Y + ²/₃ stop
Cool white	30M + ²/₃ stop	40M + 10Y + 1 stop	10R + 50M + 50Y + 1²/₃ stops
Cool white deluxe	20C + 10M + ²/₃ stop	20C + 10M + ²/₃ stop	20M + 40Y + ²/₃ stop
Unknown	10B + 10M + ²/₃ stop	30M + ²/₃ stop	50R + 1 stop

Neutral density

Neutral density (ND) filters have no effect on colour, but simply cut down the amount of light entering the lens, allowing you to use a larger stop, longer exposures or to take pictures of objects which are otherwise far too bright (such as the sun). The values listed are the strengths available using single filters, though other strengths can be obtained using combinations. The precise effects of these filters will vary depending on the conditions of use, as there will be reciprocity effects with long exposure times, so you should experiment

Filter	Filter factor	Transmission (%)	Exposure increase in stops
0.1	1¼	80	¹/₃
0.2	1½	63	²/₃
0.3	2	50	1
0.4	2½	40	1¹/₃
0.5	3	32	1²/₃
0.6	4	25	2
0.7	5	20	2¹/₃
0.8	6	16	2²/₃
0.9	8	13	3
1.0	10	10	3¹/₃
2.0	100	1	6²/₃
3.0	1000	0.1	10
4.0	10,000	0.01	13¹/₃

Colour compensating (CC)

These filters are very useful for making slight modifications to colour temperature so that you can get the exact colour that you want. They can also be used to give slight colour casts for creative effect. And used in filter packs they can correct for unusual lighting, such as fluorescent (see separate table). When mentioned in tables or articles they are often written without the CC prefix. But in technical information and on the packets they come in, they carry the prefix shown in the table.

Cyan	CC05C	CC10C	CC20C	CC30C	CC40C	CC50C
exposure increase	¹/₃ stop	¹/₃ stop	¹/₃ stop	²/₃ stop	²/₃ stop	1 stop
Magenta	CC05M	CC10M	CC20M	CC30M	CC40M	CC50M
exposure increase	¹/₃ stop	¹/₃ stop	¹/₃ stop	²/₃ stop	²/₃ stop	²/₃ stop
Yellow	CC05Y	CC10Y	CC20Y	CC30Y	CC40Y	CC50Y
exposure increase		¹/₃ stop	¹/₃ stop	¹/₃ stop	¹/₃ stop	²/₃ stop
Red	CC05R	CC10R	CC20R	CC30R	CC40R	CC50R
exposure increase	¹/₃ stop	¹/₃ stop	¹/₃ stop	²/₃ stop	²/₃ stop	1 stop
Green	CC05G	CC10G	CC20G	CC30G	CC40G	CC50G
exposure increase	¹/₃ stop	¹/₃ stop	¹/₃ stop	²/₃ stop	²/₃ stop	1 stop
Blue	CC05B	CC10B	CC20B	CC30B	CC40B	CC50B
exposure increase	¹/₃ stop	¹/₃ stop	²/₃ stop	²/₃ stop	1 stop	1¹/₃ stop

Professional photographers tend to use a vast array of equipment in their work but this is mainly because they need to get pictures despite many unpredictable limitations. In ordinary circumstances the most basic equipment is often perfectly adequate. To see how a professional would do on an 'amateur' assignment with amateur equipment, we asked Chris Barker to try photographing his children with just an Olympus Trip and a small Rollei flash.

'I came across several difficulties,' said Chris. 'In particular it took me some time to get used to the non-TTL viewfinder. Being used to an SLR I had a tendency to assume that because everything looked sharp, the camera was in focus. Also, the fixed wide angle lens made framing difficult and forced me to move in much closer than I would have liked. If given the choice I would certainly have used a longer lens such as a 105 mm on an SLR.'

In addition to the technical problems caused by the Trip's limitations, Chris also had more human problems with his subjects. The girls were happy to pose indefinitely but his son was a rather reluctant subject. Chris had to waste a certain amount of film, shooting a number of shots in an attempt to break the ice.

Looking around the location in which he had chosen to shoot, a friend's garden, Chris found and used a selection of props. The rose and slide were 'a bit

Barrel *Rather than try to persuade his unwilling son to smile, Chris posed him by a convenient barrel and took this moody portrait*

Slide *The slide was too small to allow for real action shots so Chris posed the girl on top and waited for the wind to catch her hair and add life*

Double portrait *Chris had to get in very close to frame the pair tightly and in general he found the Trip's lens frustratingly wide*

A Trip with the kids

Snapshots of their children probably give more people more pleasure than almost any other kind of photograph. We gave Chris Barker an Olympus Trip and a small flash to find out how good results can be achieved with even the most basic equipment

corny but effective' and the swing helped add a touch of variety with a few action shots.

Quite early on in the session Chris decided that using the sun as backlighting, with the flash providing fill-in light, could give attractive results. First, the children, with the sun behind them, had no tendency to squint. Second, the sun made a delightful golden fringe of the children's blond hair and this could be made to stand out attractively against a dark, shady background. Nevertheless, Chris felt that he would have preferred

Boy *Trying to make the most of the location, Chris searched out pleasing bits of the garden to act as backgrounds for the children*

Rose *Though slightly corny, Chris like this shot, feeling that the girl's pensive, almost melancholy, look rescued it from being to clichéd*

JUDGING ACTION SHOTS

Action shots are notoriously difficult to shoot well, though the range of
equipment now available certainly helps. Still, as our panel found,
many shots still fall down on basic technical errors

A

B

C

D
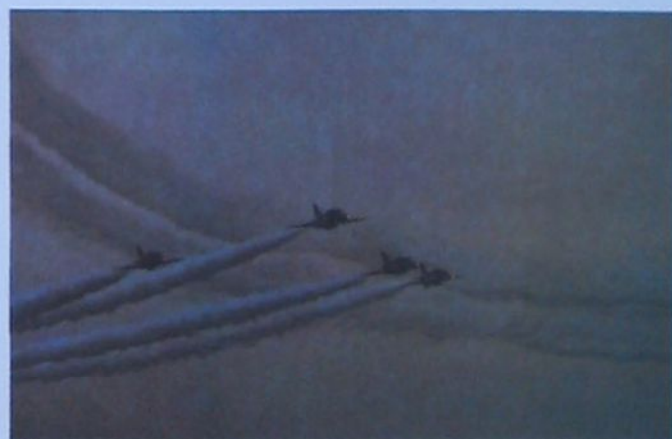
The photographers' choice:

John Sims	**A B C D**
Homer Sykes	**C B A D**
Ian McKinnell	**A B C D**
Colin Molyneux	**B C A D**

There was a large degree of agreement among the members of the panel concerning these action shots—they all disliked them! Several of the panel had strong technical criticisms to make. John Sims said 'Two of the pictures are out of focus and one is heavily underexposed' while Ian McKinnell felt that only A possessed any real merit, the other three being 'a catalogue of disasters'.

Shot D was placed last by every judge, largely because the degree of under-exposure made it very difficult even to see what was going on. Both Ian McKinnell and John Sims called it 'a missed opportunity'. There was more disagreement about shot A—both McKinnell and Sims put it first, Sims because he felt that 'at least the colours are strong and the situation is interesting.' Colin Molyneux and Homer Sykes placed it third, Molyneux disliking the framing with the subjects' feet cut off 'though there is nothing in the top of the frame to justify such drastic surgery'. Sykes thought it would have been improved by shooting from in front—'it looks as though there ought to have been some interesting expressions'.
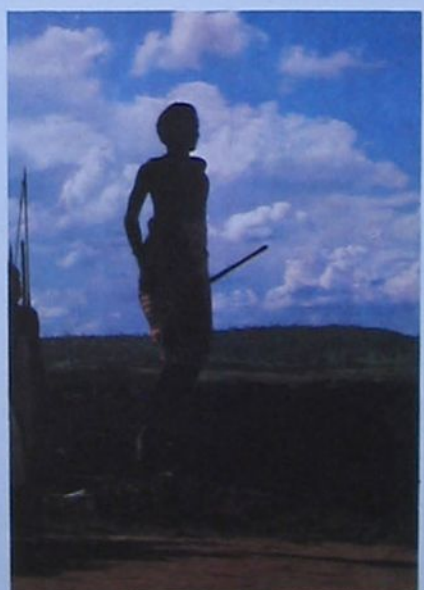
Shots B and C fared reasonably well against weak opposition. Homer Sykes placed C first but recommended the use of a much longer lens for such shots—'at the moment the planes are so small I can hardly see them'—while B was thought to be 'simple but boring'.

Colin Molyneux put shot B first 'simply because I'm a car fanatic' while conceding that 'the action is frozen somewhat'. Overall the impression was one of opportunities wasted through poor technique and lack of imagination —even correct exposure and focusing would have improved the standard of the photographs greatly.

Shooting the boss

A portrait session can be used to make a simple likeness of the subject,
but here photographer Brian Griffin shows that it can also be used to make
a strong, mysterious image of a man and his working environment

The prospect of photographing a business man in his working surroundings might not inspire every photographer, but, as Brian Griffin shows, even such an unpromising assignment has tremendous creative possibilities—providing you are prepared to use your imagination. Griffin has a reputation for his inventive portraiture and to show just what could be done we asked him to photograph a successful businessman—David Maroni, Director of External Relations for Olivetti.

The popular treatment for a subject like this—the kind of treatment you often see in news magazines—is to install the subject behind a suitably impressive

Graphic portrait *While Brian did not actually direct Mr Maroni, he looked for and exploited natural movements. Here the hands became an important part of the portrait—something which was not planned initially. The uncorrected warmth of the tungsten light gave contrast to the blue background*

The location. Above left
*Surrounded by four lights,
Brian tilted the camera
for a more dynamic
viewpoint.* **Above** *Mr
Maroni stood in a corridor
window facing a very hot
tungsten lamp.* **Left**
*Brian's assistant Philippa
stood in so that he could
prepare his shots*

desk, perhaps shooting with a wide
angle to emphasize his awesome power.
But Brian looked for a much stronger
image—instantly striking, but designed
to mystify the viewer, or as he put it, 'a
jarring combination of reality and the
unreal.'

Brian prefers not to plan things
beforehand—'I like to place myself in a
predicament by not knowing what I'm
going to do until the last minute.
Sometimes it's really hard to find things
to do, but I find I become stimulated by
the situation itself.'

In this case he arranged to work in a
vacant office. This gave him time to work
out his approach and build up the shot
just as a still life photographer might do.
Only at the last minute did he ask the
director to step in.

After much walking around the office
and a bit of head scratching, Brian finally
started to concentrate on a corner of the
room where there was just a small table,
bare except for a telephone. A pair of
long, narrow windows looked out into the
corridor and behind the table daylight
streamed through blinds cover-ing an
outside window. The telephone became
the centre of interest to Brian—both in
terms of its shape as an object and for its
significance to someone working in the
world of public relations.

After studying this area of the room in
detail, checking viewpoints and
arranging the table and the telephone,
Brian started to get a pretty accurate
idea of what he wanted to do. The blinds

Through a window *Using the same basic
set-up, Brian positioned one lamp in the
corridor, asking Mr Maroni to stand in
the window to create a more
enigmatic portrait*

were closed almost completely to
reduce the daylight entering the office
and four 'Redhead' studio lights were
brought out on their stands. These are
tungsten lights which Brian likes to use—
they have barn doors which allow the
spread of light to be controlled and allow
him to attach gels to introduce colour to
fairly stark, monochrome surroundings.

The arrangement of these four lights is
crucial to Brian's portraiture and was the
most time consuming part of the job. A
narrow beam of light was used to pick out
the telephone, throwing a distinct
shadow on the wall behind. Another
lamp was covered with a blue gel to
throw an unusual lighting effect up from
underneath the table. A third lamp, also
fitted with a blue gel, was aimed at a
reflector to bounce a hint of blue on the
wall behind the table. The fourth lamp
was reserved for lighting the director
himself—adjacent to the camera in the
case of the first shot or in the corridor in
the case of the second.

The photographs were taken using a
Hasselblad fitted with a 60 mm lens and
mounted on a tripod. Ektachrome 64
daylight film was used, but Brian also
took several Polaroid shots at various
stages to help him check that he was
building up the effect he was after.

The final images use no extra props—
just the objects that were found in the
room. The design of the building and the
surrounds in general are as important as
the man himself. The director almost
became an incidental part of the picture
—someone introduced at the very end to
complete the scene. At this final stage
Brian preferred not to give directions to
the subject—he just told him where to
stand and allowed Mr Maroni to respond
in a way that he felt suited the scene.

DATA Photo facts

There are many bits of information and tips which you will find helpful, both in your everyday work and when you are trying something a little more special, and some of the most important ones are included here

Hyperfocal distance

Any focal length lens has a range of hyperfocal distances—one for each aperture. The hyperfocal distance is that focus setting at which the lens will give the maximum depth of field at that aperture. This depth of field extends from half the hyperfocal distance to infinity and increases as the aperture becomes smaller.

The tables given below indicate the hyperfocal distances for various focal length lenses at different apertures. One of the tables is based on the standard circle of confusion of 0.033 mm, the other is based on a more critical 0.025 mm (see pages 962 to 963). To use the tables, look at the figure indicated for the focal length lens you are using, at the working aperture, and set this distance on the lens. For example, if you are using a 35 mm lens at an aperture of f/5.6 you can, by setting the focus to 6.62 m, achieve acceptable sharpness from 3.31 m to infinity.

c × 0.033 mm

Focal length / Aperture	17	21	24	28	35	50	85	100	135	200	300
1.4	6.25	9.54	12.40	16.90	26.50	54.10	156	216	394	856	1948
2	4.37	6.68	8.72	11.80	18.50	37.80	109	151	276	606	1363
2.8	3.12	4.77	6.23	8.48	13.20	27.00	78.1	108	197	432	974
4	2.18	3.34	4.36	5.93	9.28	18.90	54.7	75.7	138	303	681
5.6	1.56	2.38	3.11	4.24	6.62	13.50	39.0	54.1	98.6	206	487
8	1.09	1.67	2.18	2.96	4.64	9.46	27.3	37.8	69.0	151	340
11	0.79	1.21	1.58	2.15	3.37	6.88	19.9	27.5	50.2	110	247
16	0.54	0.83	1.09	1.48	2.32	4.73	13.6	18.9	34.5	75.7	170
22	0.39	0.60	0.79	1.07	1.68	3.44	9.95	13.6	25.1	55.0	123
32	0.27	0.41	0.54	0.74	1.16	2.36	6.84	9.95	17.2	37.8	85.2

c × 0.025 mm

Aperture	17	21	24	28	35	50	85	100	135	200	300
1.4	8.25	12.6	16.4	22.4	35	71.4	206	285	520	1142	2571
2	5.78	8.82	11.5	15.6	24.5	50	144	200	364	800	1800
2.8	4.12	6.3	8.22	11.2	17.5	35.7	103	142	260	571	1285
4	2.89	4.41	5.76	7.84	12.2	25	72.2	100	182	400	900
5.6	2.06	3.15	4.11	5.6	8.75	17.8	51.6	71.4	130	285	642
8	1.44	2.20	2.88	3.92	6.12	12.5	36.1	50	91.1	200	450
11	1.05	1.60	2.09	2.85	4.45	9.09	26.2	36.3	66.2	145	327
16	0.72	1.10	1.44	1.96	3.06	6.25	18.0	25	45.5	100	225
22	0.52	0.80	1.04	1.42	2.22	4.54	13.1	18.1	33.1	72.7	163
32	0.36	0.55	0.72	0.98	1.53	3.12	9.03	12.5	22.7	50	112

Close-up exposure increase

When a camera is used for close-up work with the lens mounted on extension tubes or bellows, the f-stop markings no longer give an accurate indication of the amount of light reaching the film. Cameras with TTL metering will automatically compensate for this but for manual cameras it is necessary to refer to formulae or tables to calculate the additional exposure required. Given below are two formulae and a reference table covering most common set-ups.

Estimating magnification can also be difficult. On a 5 × 4 camera, it is possible to measure both the size of the subject and the size of the image on the ground glass screen and so work out the magnification. With 35 mm cameras, the full frame dimensions of 24 × 36 mm give you a basis for calculation. With reproductions of life size or larger, working from the formulae will give optimum accuracy.

$$\text{Required exposure time} = \text{indicated meter exposure} \times \frac{(\text{length of bellows})^2}{(\text{lens focal length})^2}$$

$$\text{Required exposure time} = \text{indicated meter exposure} \times (m + 1)^2$$

Magnification	0.25	0.5	0.75	1	1.25	1.5	1.75	2	3
exposure factor	1.5	2.2	3	4	5	6.5	7.5	9	16

Sharpness control *The lens used for the seascape shot was focused at its hyperfocal distance in order to gain the maximum possible depth of field, extending all the way to infinity. Depth of field in close-up work is much more limited, as shown in the picture of a printed circuit board (far right), so it is essential to use the shallow sharpness creatively, to emphasize part of the subject*
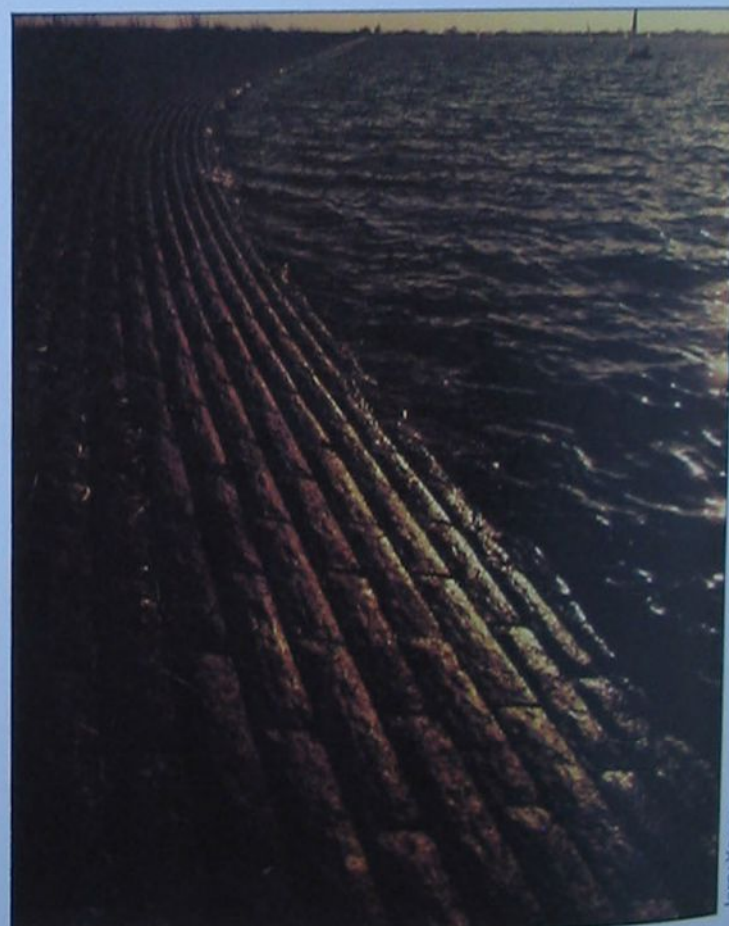
Reciprocity failure compensation

In normal use the speed and colour balance of a film remains unchanged. For example, two shots taken at 1/125 second at f/4 and 1/250 second at f/5.6 of the same subject under the same conditions will have the same density and colour balance. When exposures get very short (1/10,000 second or less) or long (more than one second) the film reacts differently and adjustments have to be made by means of filters and extra exposure. The following table gives some recommended adjustments for the most popular Kodak films. For other films you should experiment, basing your tests on the nearest type of film given below. Alternatively obtain information from the film's manufacturer.

Film	Exposure time (seconds)					
	1/1000	1/100	1/10	1	10	100
EKTACHROME 64 and 64 Professional (Daylight)	None No filter	None No filter	None No filter	+ 1 stop CC 15B	+ 1½ stops CC 20B	Not recommended
EKTACHROME 160 and 160 Professional (Tungsten)	None No filter	None No filter	None No filter	+ ½ stop CC 10R	Not recommended	Not recommended
EKTACHROME 400 (Daylight)	None No filter	None No filter	None No filter	+ ½ stop No filter	+ 1½ stops CC 10C	+ 2½ stops CC 10C
EKTACHROME 50 Professional (Tungsten)	+ ½ stop CC 10G	None No filter	None No filter	None No filter	+ 1 stop CC 20B	Not recommended
EKTACHROME 200 and 200 Professional (Daylight)	None No filter	None No filter	None No filter	+ ½ stop CC 10R	+ 1 stop CC 15R	Not recommended
KODACOLOR 400	None No filter	None No filter	None No filter	+ ½ stop No filter	+ 1 stop No filter	+ 2 stops No filter
KODACHROME 25 (Daylight)	None No filter	None No filter	None No filter	+ 1 stop CC 10M	+ 1½ stops CC 10M	+ 2½ stops CC 10M
KODACHROME 64 (Daylight)	None No filter	None No filter	None No filter	+ 1 stop CC 10R	Not recommended	Not recommended
KODACOLOR II	None No filter	None No filter	+ ½ stop CC L0C	+ ½ stop CC 15C	+ 1½ stops CC 30C	+ 1½ stops CC 30C

Close-up depth of field

Calculating depth of field is often important but never more so than in close-up work where the depth of field available at the working aperture is likely to be both small and very important. It is possible to make rough visual checks on depth of field at different apertures with most SLR and large format cameras but the darkened screen makes such estimates both difficult and crude. For crucial work it is best to refer to a table. The tables printed here show the depth of field available at different apertures and magnifications/reproduction ratios. One of the tables is based on a standard circle of confusion of 0.033 mm—the other uses a figure of 0.025 mm and is recommended for more critical work. In both cases the figures give the depth each side of the main focus—for total depth of field in mm double the figures.

c = 0.033 mm

Mag. ratio	0.1 1:10	0.13 1:8	0.17 1:6	0.2 1:5	0.25 1:4	0.33 1:3	0.5 1:2	0.67 2:3	1 1:1	1.5 3:2	2 2:1	2.5 5:2	3 3:1
1.4	5.08	3.08	1.87	1.38	0.92	0.56	0.27	0.17	0.092	0.051	0.034	0.025	0.02
2	7.26	4.41	2.67	1.98	1.32	0.08	0.39	0.24	0.13	0.073	0.049	0.036	0.029
2.8	10.1	6.17	3.74	2.77	1.84	1.12	0.55	0.34	0.18	0.10	0.069	0.051	0.041
4	14.5	8.82	5.34	3.96	2.64	1.61	0.79	0.49	0.26	0.14	0.099	0.073	0.058
5.6	20.3	13.3	7.48	5.54	3.69	2.25	1.10	0.68	0.36	0.2	0.13	0.1	0.082
8	29	17.6	10.46	7.92	5.28	3.22	1.58	0.98	0.52	0.29	0.14	0.14	0.11
11	39.9	24.2	14.6	10.8	7.26	4.43	2.17	1.35	0.72	0.4	0.2	0.2	0.16
16	58	35.3	21.3	15.8	10.5	6.44	3.16	1.96	1.05	0.58	0.29	0.29	0.23
22	79.8	48.5	29.3	21.7	14.5	8.26	4.35	2.7	1.45	0.08	0.4	0.4	0.32
32	116	70.6	42.7	31.6	21.1	12.8	6.33	3.92	2.11	1.17	0.59	0.59	0.48
45	163	99.2	60.1	44.5	29.7	18.1	8.91	5.52	2.97	1.65	0.83	0.83	0.66
64	232	141	85.5	63.3	42.2	25.7	12.6	7.85	4.22	2.34	1.18	1.18	0.93

c = 0.025 mm

Mag. ratio	0.1 1:10	0.13 1:8	0.17 1:6	0.2 1:5	0.25 1:4	0.33 1:3	0.5 1:2	0.67 2:3	1 1:1	1.5 3:2	2 2:1	2.5 5:2	3 3:1
1.4	3.85	2.34	1.41	1.05	0.7	0.42	0.21	0.13	0.07	0.038	0.026	0.019	0.015
2	5.5	3.34	2.02	1.5	1	0.61	0.3	0.18	0.1	0.055	0.037	0.028	0.022
2.8	7.7	4.68	2.83	2.1	1.4	0.85	0.42	0.26	0.14	0.077	0.052	0.039	0.031
4	11	6.68	4.04	3	2	1.22	0.6	0.37	0.2	0.11	0.075	0.056	0.044
5.6	15.4	9.36	5.66	4.2	2.8	1.7	0.84	0.52	0.28	0.15	0.1	0.078	0.062
8	22	13.3	8.09	6	4	2.44	1.2	0.74	0.4	0.22	0.15	0.11	0.088
11	30.2	18.3	11.1	8.25	5.3	3.35	1.65	1.02	0.55	0.3	0.2	0.15	0.12
16	44	26.7	16.1	12	8	4.88	2.4	0.48	0.8	0.44	0.3	0.22	0.17
22	60.5	36.7	22.3	16.5	11	6.71	3.3	2.04	1.1	0.61	0.41	0.3	0.24
32	88	53.4	32.3	24	16	9.77	4.8	2.97	1.6	0.88	0.6	0.44	0.35
45	123	75.2	45.5	33.7	22.5	13.7	6.75	4.18	2.25	1.25	0.84	0.71	0.63
64	176	100	64.7	48	32	19.5	9.6	5.96	3.2	1.77	1.2	0.89	0.21

Paul Brierley

Coloured sky *The colour of the sky in this shot is due to reciprocity failure. This is one of the occasions when a cast is actually attractive, and so no filtration is needed*

Evening light *The colour temperature of the light source rarely matches the photographic standard of 5500K. But in some cases, such as at sunset, this is not a problem*
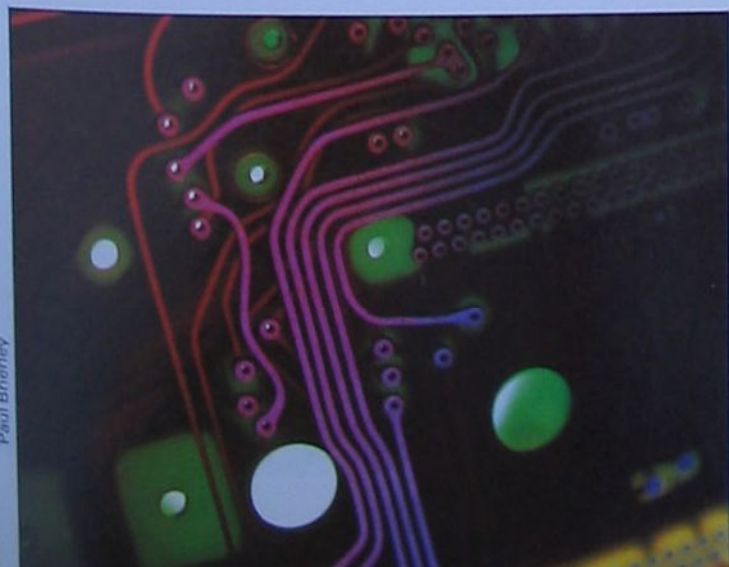
Movie film running times and lengths

Most movie cameras have counters which tell you how much film is left. But it is not always easy to work out what this means in terms of time. Using the table below you can work out how much time you have available or how long a sequence will last.

Film format	Super 8 (72 frames per foot)		16mm (40 frames per foot)	
Projection speed in frames per second	18	24	18	24
Running time and film length	Feet + frames	Feet + frames	Feet + frames	Feet + frames
Seconds 1	0+18	0+24	0+18	0+24
2	0+36	0+48	0+36	0+48
3	0+54	1+ 0	1+14	1+32
4	1+ 0	1+24	1+32	2+16
5	1+18	1+48	2+10	3+ 0
6	1+36	2+ 0	2+28	3+24
7	1+54	2+24	3+ 6	4+ 8
8	2+ 0	2+48	3+24	4+32
9	2+18	3+ 0	4+ 2	5+16
10	2+36	3+24	4+20	6+ 0
20	5+ 0	6+48	9+ 0	12+ 0
30	7+36	10+ 0	13+20	18+ 0
40	10+ 0	13+24	18+ 0	24+ 0
Minutes 1	15+ 0	20+ 0	27+ 0	36+ 0
2	30+ 0	40+ 0	54+ 0	72+ 0
3	45+ 0	60+ 0	81+ 0	108+ 0
4	60+ 0	80+ 0	108+ 0	144+ 0
5	75+ 0	100+ 0	135+ 0	180+ 0
6	90+ 0	120+ 0	162+ 0	216+ 0
7	105+ 0	140+ 0	189+ 0	252+ 0
8	120+ 0	160+ 0	216+ 0	288+ 0
9	135+ 0	180+ 0	243+ 0	324+ 0
10	150+ 0	200+ 0	270+ 0	360+ 0

Flash guide numbers

It is essential to know the guide number of your flashgun but manufacturers do not always quote a full set of numbers. By using this table you can work out the guide number of a flashgun at any of the given film speeds, provided that you know one number. For example, if your unit has a guide number of 22 with 64 ASA (ISO) film, simply look down the 64 ASA column until you come to 22. Then, by reading along that row, you can find the number for the other speeds. In this example the unit has a guide number of 40 with 200 ASA film.

The BCPS (beam candle power seconds) rating is a standard measure of light power and is useful for technical applications, such as infrared photography. The joules rating is a more common system of giving the power of a unit, and the power of most studio flash heads is quoted in joules

25	50	64	80	100	160	200	400	BCPS	Joules (watt/seconds)
6	9	10	11	12	16	18	25	300	8
7	10	11	12	14	18	20	28	375	10
8	11	12	14	16	20	22	32	450	12
9	12	14	16	18	22	25	35	600	16
10	14	16	18	20	25	28	40	750	20
11	16	18	20	22	28	32	45	900	25
12	18	20	22	25	32	35	50	1200	32
14	20	22	25	28	35	40	56	1500	40
16	22	25	28	32	40	45	64	1800	50
18	25	28	32	35	45	50	70	2400	64
20	28	32	35	40	50	56	80	3000	80
22	32	35	40	45	56	63	90	3600	100
25	35	40	45	50	63	70	100	4800	125
28	40	45	50	56	70	80	113	6000	160
32	45	50	56	63	80	90	128	7200	200

Colour temperature and mireds

If you want to get accurate colours in your transparencies it is essential to filter for different light sources. Working out the required filtration is easy if you have a colour temperature meter. Otherwise it is difficult to know what colour temperature a particular light source is. The table here gives a guide to the most common or important sources, measured in kelvins. However, the exact colour of any lighting can be affected by the age of bulbs or tubes, the colour of reflectors or surrounding surfaces, and so on. Nevertheless, for all but the most critical conditions, this guide should be sufficiently accurate.

To find the necessary filtration you can use the kelvin/mired scale. Mireds (micro reciprocal degrees) are used because a filter can then be given a set value which applies to any region of the colour temperature range. For example, a filter with a mired shift value of −100 can change the colour temperature from 2000 to 2500 K—a shift of 500 K. But it can also change it from 5000 to 10,000 K—a shift of 5000 K. So filters cannot simply be allotted a colour temperature. The mired scale is derived by dividing the colour temperature into 1,000,000. Blue filters have negative mired values, and red, yellow and amber filters have positive values. Some colour temperature meters, such as the Minolta digital model, give readouts directly in mired values, which are then read off a table to find the correct filters to use. Some approximate mired values are given here for the most common filters, but you should check with the filter's instructions. The point to remember about mireds is that a filter alters the mired value by the same amount whatever the light source, but the change in degrees kelvin varies with the colour temperature of the light.

Candle	1930
Sunrise/sunset	c.2000
40 watt domestic bulb	2650
75 watt domestic bulb	2820
100 watt domestic bulb	2900
200 watt domestic bulb	2980
500 watt photographic lamp	3200
Projector lamps	3100
500 watt photoflood	3400
'Daylight' fluorescent light	4500
Mean noon sunlight	5400
Photographic daylight	5500
Flashcube	5500
Blue flashbulb	6000
Electronic flash tube	6000
Average daylight (sun and sky)	6500
Colour matching fluorescent tube	6500
Overcast daylight	7500
Blue sky	10,000 to 18,000

Mired values for common filters

81	+ 10	82	− 10
81A	+ 15	82A	− 20
81B	+ 25	82B	− 30
81C	+ 30	80A	− 130
85B	+ 130	80B	− 110
85C	+ 80	80C	− 80

Sources

Much of the information used in this article was supplied by Kodak. Many of the terms used, such as Wratten, Ektachrome and Kodachrome are Kodak trade names. The hyperfocal distance and depth of field tables were calculated using a Sinclair ZX Spectrum computer.

Kelvins — Mireds scale:

Kelvins	Mireds
20 000	50
10 000	100
6500	150
6000	
5400	
5000	200
4500	
4000	250
3800	
3600	
3400	300
3200	
3000	
2850	350
2500	400
2360	
	450
2000	500

Hints and tips

Many of the useful little tricks in photography you can learn only by experience. So we asked a few professionals to pass on a few hints and tips on how they save time, money and frustration by little changes to their equipment

For long exposures without a cable release use the delayed-action timer. If using long lenses (more than 300 mm) the mirror lock up (if fitted) should always be used

Flash cables are easy to trip over and to lose. Painting yellow bands at intervals minimizes both problems

If you lack an adequate lens hood, your left hand makes a reasonable substitute. Use high shutter speeds to prevent shake and study the viewfinder carefully for positioning to avoid vignetting

Roger Payling

Carry equipment in nondescript cases to mislead potential thieves. Line them with foam rubber for protection

Rolling film from 30 metre lengths cuts the unit cost enormously. Do not use metal cassettes more than three times

Cut cases to a minimum. Most lens cases and all ERCs are generally unnecessary and merely waste valuable time

Wrapping a white handkerchief loosely round a flash unit helps to slightly diffuse the light—but be careful to keep the sensor clear of obstructions

Stopping down to very small apertures (f/16 or f/22) gives a 'starburst' effect without filters

To prevent oxidisation of chemicals, store them in plastic bags sealed with rubber bands. Alternatively squirt aerosol dust-remover into bottles before sealing to expel oxygen

The most compact way to transport 35 mm films safely is in fours in standard Kodachrome slide boxes. Alternatively keep individual films in canisters, marking the type with a wax pencil

For fashion shots, use pins, bulldog clips and sticky tape out of the camera's view to make clothes look as if they fit perfectly—even if they do not

Always take plenty of film on holiday. Buying abroad is often risky, expensive or impossible and it is better to have all your film from the same batch

Buy a good Swiss Army knife—the type with a screwdriver—it could easily become your most useful photographic accessory

Hard cases give equipment the best protection but are less accessible than soft bags. Some professionals use a large hard case to take the equipment they think they might need *to* a shoot and a smaller bag for taking the equipment they actually do need *on* the shoot

Simple colour-tape coding of film canisters will aid speedy access—red for colour, blue for b & w, for example

Always check that a loaded film is advancing properly by making sure the rewind knob is rotating

Keep a small tripod permanently in your car in case you forget your usual one and a small flash in your case for similar 'insurance'

If individual filter cases are clearly marked on the rim with self-adhesive labels bearing the type it makes identification much quicker

A string bag takes up little space and can be filled with stones and hung from a tripod to aid stability

Carry a set of jewellers' screwdrivers and tighten all screws on equipment frequently

Keep a data book in your gadget bag containing film slips, developer slips, addresses—any useful information

Gaffer tape is useful but bulky in rolls. Keep it in strips on cases, tripods legs etc Rip off the leaders of exposed films to prevent accidental re-use

A small stock of self-adhesive labels is invaluable. Use them, for example, to mark records directly on to film canisters—'exposed at 200 ASA'

Velcro is useful for all sorts of purposes, both in the darkroom and gadget bag. Use it for sealing gaps in blackouts, for 'quick-release' flaps on jackets, for setting up background material (it allows fine adjustment) and for a great variety of other jobs

Don't use washing up liquid as wetting agent—it often contains impurities and is a false economy

When out shooting, wear a jacket with deep pockets for small items you may need quickly—and keep one aside for you lens cap

Chris Steele-Perkins/Magnum

Ian Berry/Magnum

World of photography

STYLES OF PHOTOGRAPHY

A variety of different and often highly individual styles can be found in almost every kind of photographic work—ranging from photojournalism to fashion and advertising

It is easy to spot the difference between the rather anonymous pictures of executives that often appear in company house magazines and the gripping, dramatic portraits produced by such distinguished photographers as Bill Brandt or Arnold Newman. Photographers like Brandt and Newman have developed for themselves a unique photographic style.

It is the distinctive style that makes the work of such photographers stand out from the neutral one-dimensional effect achieved by most photographers. By using a particular approach to a subject, the photographer is trying to convey more information to the viewer. And, depending on the style of photography used, this may be information about the character of a person, about the photographer's view of the world or an attempt to communicate certain feelings and attitudes.

Nowadays photography is so popular that there are photographers working in almost every conceivable style. But in the first 100 years of photography—

Palestinian troops, Beirut, 1982 Although working under difficult conditions, Steele-Perkins has given this shot a formal style characteristic of much of his work. **Carnival, Rio, Brazil** While breaking most of the usual rules, the photographic style of Ian Berry succeeds in being both informative and amusing

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André Kertész

partly because of the limitations imposed by early equipment and film—photographers would often unite together into groups to pioneer a particular way of looking at the world. As a result it is fairly easy to identify distinct photographic movements, or schools, each with its own clearly identifiable style of photography.

During the early stages of its development, photography was so closely associated with painting that people tended to see it merely as a new kind of painting. Many photographers consciously imitated both the styles and the subject matter of painting. These were the 'High Art' photographers of the mid 19th century (see page 677), with their contrived photographs of classical and sentimental subjects.

Following soon after was the photographic movement initiated by the pictorialists and, in particular, the Photo-

January 1st, 1972, Martinique *One of Kertesz's favourite pictures, its success lies in its enigmatic quality which leaves the viewer puzzling about the figure*

Ralph Gibson/photograph from "The Somnambulist"

The open door *A disturbing and slightly surreal image taken from Gibson's book 'The Somnambulist' in which he frequently uses elements of metaphor and symbol*

Hands, 1931 *Man Ray was a leading member of the Surrealist movement of the 1930s—he was one of the first photographers to exploit solarization*

Man Ray/photograph courtesy of Sotheby's Belgravia

Sarah Moon/photography courtesy of Olympus Camera Centre

Flying machine *This picture for the 1975 Philips Calendar is typical of Sarah Moon's use of soft focus and sepia printing to heighten the sense of nostalgia*

New York, 1946 *(below) One of the many bizarre and humorous pictures of dogs which Erwitt took over a long period and published in his book 'Son of Bitch'*

Elliott Erwitt/Magnum

Secessionists (see page 1504) who wanted to show that photography could be a fine art. The pictorialists rejected the idea that the subject matter and detail were all-important. Defying the narrow minded attitude current to photography as art, they wanted to place more emphasis on the mood and feeling expressed by a photograph. This movement was undoubtedly the most important influence on photography's acceptance as a fine art in its own right.

But like so many revolutionary movements, pictorialism was to be rejected in its turn—this time by the trend in the 1920s towards a more realistic photographic style. This was particularly shown in the work of Paul Strand and Edward Weston and the f/64 Group (see page 2000).

The emergence of such a style was also influenced by the enormous improvements in photographic equipment and techniques, and the revolutionary movements in modern art. Its most distinguishing characteristics were its choice of an often commonplace subject matter—which might range from manufactured objects to details of plant and natural forms—and the highly detailed realistic treatment of these subjects. Although taken for granted nowadays, this was an extraordinarily revolutionary development in the 1920s.

The great explosion of interest in photography in the early 20th century and its subsequent development as one of the most widely practised arts led in turn to the development of an immense variety of styles.
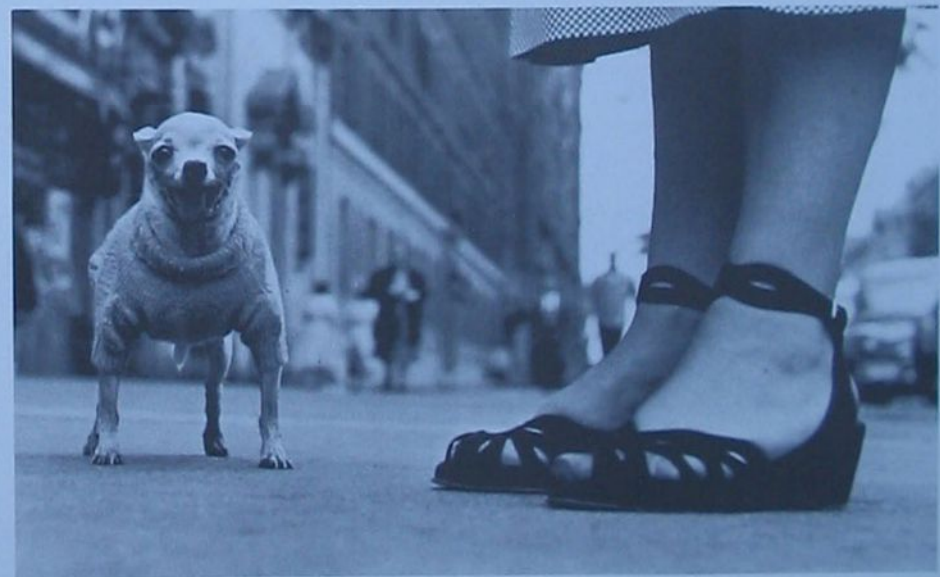
Often styles that seem strongly opposed may sit side by side in the same city, even in the same publication. For example, in the late 1960s the romantic style of Sarah Moon was as famous and highly regarded as the hard-edged, dramatic compositions of David Bailey. Nevertheless, it is still possible to see the work of most photographers as falling within a general style of photography, although some will fit more easily into these general categories than others. It is, for example, easy to see that Man Ray is a Surrealist or that David Hamilton is a Romantic, but it is far more difficult to categorize the work of a photographer such as André Kertész.

Marlene Dietrich, 1932 *One of the carefully stylized pictures taken under the artistic direction of the film director Joseph Von Sternberg. This was for 'Shanghai Express'*

Austrian village *Travel photos like this depend on an unchallenging, anonymous style that aims simply to present a pretty picture of a pretty scene*

Kertész has influenced a large number of photographers working in very different areas and although he has maintained a strong individuality he has never been content to keep to one particular approach.

So while it is useful to be able to differentiate between the major styles of photography, it is misleading to think that all photographers will fit easily into separate categories. In addition, there are many photographers who may occasionally work within a number of different styles. Furthermore, although some photographic styles are easy to define, there are others whose direction is far less clear. Those which are fairly clearly defined have been given descriptive headings such as Romantic, Surrealist, Dramatic, Symbolic, Abstract and Documentary.

Surrealism was the name given to a modern art movement which developed in the 1920s. In painting it took the form of montages or straight paintings which expressed ideas formed in the subconscious. These ideas were usually based on dreams and fantasy but expressed in a realistic form, such as Magritte's paintings of faceless beings in strange, half-real settings.

Those photographers who were attracted by this way of expressing their ideas had a variety of photographic techniques at their disposal. One of the greatest Surrealists, Man Ray, often used montage, double exposures and solarization to give his images a dreamlike quality. Modern photographers working in the same tradition have many more techniques at their disposal. But all of them are concerned above all to put across ideas, whether as visual jokes or concerned symbolism, through a combination of reality and fantasy.

The humorous side of surrealism can be seen in the more bizarre images of Jacques-Henri Lartigue (see page 1285) or more recently in the curious juxtapositions of subjects of Elliott Erwitt or Cartier-Bresson (see page 2421). With their eye for incongruity they not only produce laughter but also make their viewers aware of the bizarre world around them.

On the other hand, the multiple images that Jerry Uelsmann produces in his darkroom are far more conscious creations. Through his skills at combining and merging different images to make a whole, Uelsmann makes subtle statements about life which he prefers his viewers to interpret as they wish. Another contemporary photographer with a more stylized approach to the same method is Bob Carlos Clarke (see page 580). He often uses a combination of montage, airbrushing, hand colouring and even drawings to produce strange, nightmarish, images with great precision and control.

The experimental art movements of the 1920s also provided the inspiration for photographers to experiment with abstract images. Here pattern and form were the main subject of the image. The

Franco Fontana/The Image Bank

Paul Caponigro/photograph courtesy of Victoria & Albert Museum

Landscape *Fontana's landscapes are instantly recognizable for their broad, flat sweeps of colour. The pictures are not abstract, but highlight a new aspect of the landscape*

Rock wall, *West Hartford, Connecticut, 1959. Caponigro's style of photography tries to capture some of the emotions that natural forms can evoke*

approaches ranged from the deliberate manipulation of an image in the darkroom to produce abstract forms to the deliberate framing of a subject to portray abstraction. This was done, for example, by photographing from unusual angles, or by taking close-ups, reflections or patterns of light and shade.

These have included some of Man Ray's solarized images, the distorted nudes produced by André Kertész and Bill Brandt, and Andreas Feininger's extreme close-ups of the complex shapes contained within rocks or shells. More recently they include the remarkable range of colour work produced by Franco Fontana, whose pictures transform landscapes into broad bands and sweeps of colour by using the light and a long lens to flatten perspective (see page 1380).

The extremes of Surrealism and Abstraction are examples of 'photography as art' in its purest form and are examples of ideas developed purely as a means of self-expression. Even so, these ideas are frequently taken up and used or expanded by advertising photographers in their work. A leading example of this is in the style of the Benson and Hedges cigarette adverts in the UK, but these influences can also be seen in innumerable other advertizing photographs.

Another related style of photography deals mainly in symbols and metaphors —on the face of it, the photographs are of one thing, but there is a deeper meaning which you have to search for. Photographers use this approach as an indirect way of expressing themselves, and even in advertising photography you

can recognise elements of symbolism and metaphor.

One of the most famous of all photographers to adopt a metaphorical approach—that is, taking pictures of a particular subject to suggest something above and beyond the subject—is the American Photo Secessionist, Alfred Steiglitz. Stieglitz sought to express different moods and emotions through his photographs of clouds. Similarly Minor White's detailed pictures of nature and form are a means of expressing an inner meaning. He sees himself as the medium through which such meaning can be transformed into an image.

Other photographers use metaphor and symbolism in a far more direct manner. Wynn Bullock, for example, draws attention to the overtones of natural forms such as the faces and figures to be seen in trees, rocks and landscapes. Duane Michals also likes to use symbols in his work. For example, he often presents his viewer with series of photographs which tell a story about some intimate detail of life. These stories often contain a surreal element such as a blurred figure which reappears in each image like a ghost. These series have an intimacy about them that attracts the viewer, but the strange element leaves his viewer puzzled and disturbed.

Another photographer whose work uses elements of symbolism, metaphor and abstraction in his work is Ralph Gibson. Gibson's tightly-cropped photographs of people depersonalize them so that they become abstracts which concentrate on details of texture and pattern. In other photographs Gibson uses symbols and surreal elements to confront and question his viewers.

Styles of photography run parallel to the artistic movements and ideas of this century. Most of them are also devices used by photographers to express very personal and often restricted ideas about the world. They also generally have no other function than to please the photographer and express his thoughts and ideas—in forms that may range from the obvious to the extremely obscure.

Two more easily distinguishable photographic styles are the Romantic and the Dramatic, which are often found combined in the work of one photographer. And unlike the styles of art photography, these styles are more often to be found in a more commercial type of photography—particularly in portraiture and fashion.

In this style the photographer generally intends to convey mood, emotions, and a sense of context. The elements of the picture are carefully chosen to give, usually, a sense of elegance and glamour, and they are generally shot in the studio.

The heyday of this style of photography was in the 1930s. At this time portrait photographs were at their most popular, with clients demanding and receiving the utmost flattery. Another significant influence was in the demands
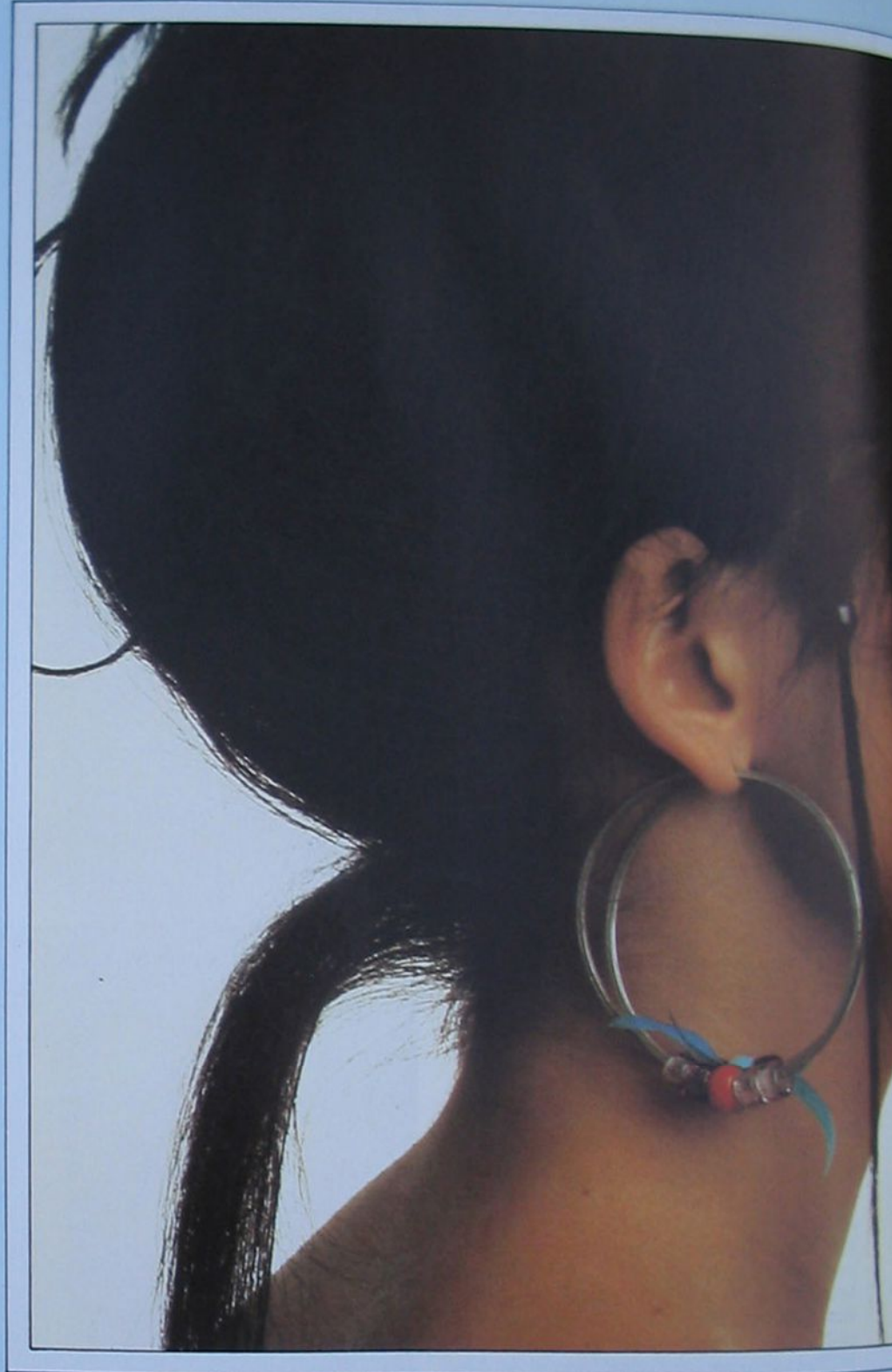
Brave face *In advertising shots like this the style of the photography is often dictated by the image of the product being advertised and the art director often chooses a photographer for his or her style*

of the fashion magazines such as *Vogue, Harper's Bazaar* and *Vanity Fair*—all of which wanted to promote glamour. Some of the most gifted exponents of this style were the fashion and portrait photographers Baron de Meyer, Yousuf Karsh and, most remarkably, Cecil Beaton (see page 716). Both de Meyer and Beaton used theatrical effect, often with elaborately constructed sets. Karsh, on

the other hand, was primarily a portrait photographer who used dramatic, low key lighting to reveal the characters of some of the most famous figures of the 1940s and 1950s.

This style was extremely popular in its time, but when the emphasis shifted away from glamour and elegance to the more straightforward styles of the 1960s it began to seem extremely over-contrived and dated.

However, the affection for the romantic did not disappear entirely, and its influence can be seen particularly in the soft-focus, muted colours in such photographers as David Hamilton and

Clive Arrowsmith/taken for Mary Quant "Brave Face" poster/Collet, Dickenson, Pearce & Partners Ltd.

photographers who worked for the early illustrated magazines have in retrospect been celebrated widely for their achievements (see page 2324). In the same way, only now is full recognition being given to the photographers of the Farm Security Administration (see page 2121) such as Dorothea Lange and Walker Evans.

However, the turning point in the recognition of the artistry of the documentary approach came in the late 1950s and early 1960s, when illustrated magazines such as *Life* and *Look* dominated the market. The young documentary photographers who worked for these magazines became celebrities themselves.

A group of photographers that played a significant role in this were the members of the photographic co-operative Magnum. They wanted to exercise some element of control over the kind of work they produced. Operating as an international agency they quickly became famous for the high quality of their human-interest stories. Among their most famous members have been Cartier-Bresson, Marc Riboud, Eve Arnold, W. Eugene Smith and Philip Jones-Griffiths (see page 112).

The documentary approach has also been used to great effect in portraiture—notably by such photographers as Arnold Newman, Bill Brandt and the young British photographer, Brian Griffin.

All of these photographers employ a highly individual style in their portraiture. Newman's effective compositions not only focus attention on his sitters but also tell us something about their backgrounds. Brandt, on the other hand, tries to use the natural tension of a photo session to bring out a particular aspect of his sitter's character. Many of his subjects gaze out of the frame with wary or suspicious expressions. Brandt may also heighten this feeling by using an unusual angle or perspective. Griffin too often uses unusual angles or lighting in his striking portraits of executives.

The distinctive style of these photographers makes it very easy to identify their work. And this is also true of many photographers working in completely different fields such as advertising, fashion, photojournalism and travel. Indeed many rely on their distinctive style to bring them work. Even so there are many successful photographers who deliberately set out to take photographs in a universal style. An example of this is the so-called 'chocolate box' style of photography where the photographer makes no attempt to stamp his or her own personality on the picture.

This kind of photography is taken for its popular appeal and, like the Romantic style of photography, it often tends to reinforce commonly-held sentiments about how the world should look. Many individual styles on the other hand tend to challenge such beliefs and may inspire dislike or even hatred before becoming established as an acceptable way of seeing.

Sarah Moon. In all these styles of photography, the style itself is usually an extremely important, if not the most important, component of the picture. In direct contrast is the documentary approach, which is primarily concerned with the subject itself. In theory this type of photography should be totally objective, but in practice individual photographers will contribute something of themselves to the picture. Such features as the choice of subject, the selection of a particular grouping or facial expression, and the use of the subject's environment all contribute towards a personal style.

Photographers have been using their cameras to document the world ever since the invention of photography but it is only in the last few decades that documentary photography has been recognised as having a clearly creative element. Nevertheless, such early documentary photographers as John Thomson, Lewis Hine and Jacob Riis all had a very distinctive style and the work of the great documentary photographers of the 1930s and 1940s has endured far beyond the events that they portrayed.

Although they were not individually recognized at the time outside the narrow world of photo-journalism, the

DATA
DARKROOM DETAILS

A quick and easy guide to the many different darkroom techniques you can try, plus tables of useful conversions, and pointers on chemical and darkroom safety

Chemical safety

All darkroom process chemicals must be regarded as potentially dangerous—even if many of them are no more harmful than ordinary household cleaning products. But some are extremely dangerous —so handle them with great care.

Take special note of any warnings which may relate to the mixing, use, storage and disposal of a particular chemical or solution. Symbols are used when specifically required by law—in the UK they take the form show. These should appear on the storage container, especially in the case of raw chemicals.

Chemicals marked 'irritant' may prove irritating to skin, eyes, or respiratory system and should be handled with gloved hands and in a room with adequate general ventilation. Wear goggles if possible, a mask if necessary.

Corrosive chemicals include many of the oxidizing agents such as nitrates, dichromates and permanganates—which occur in many of the bleaches and cleaners used in photography.

Flammable substances must be used in good ventilation and well away from naked flames (such as a hidden pilot flame) and make-and-brake electrical equipment which may spark.

Toxic substances—which includes chemicals used in some of the old processes—should be treated with special respect, and used and stored in isolation from day-to-day photographic chemicals such as developers and fixers.

Removing stains from dishes and clothes

Used utensils should always be rinsed after use to minimize chemical build ups. But when these occur one of various cleaning solutions can be used. An extremely strong cleaner (Kodak TC-1) which removes developer, silver and some dye stains can be prepared by adding 90 g potassium dichromate to 1 litre warm water, then adding at a drop at a time 96 ml concentrated sulphuric acid to the mix. NEVER add water to the acid. To use it, pour a small amount in to the vessel, swill it around and then rinse copiously.

Another strong cleaner (Kodak TC-3) for removal of silver and most other stains is a two-part formula. Solution A is prepared by mixing 2 g in 1 litre warm water, to which is added 4 ml concentrated sulphuric acid. Solution B is prepared by mixing 30 g sodium metabisulphite and 30 g sulphite in 1 litre water. To clean the vessel, pour in a little of solution A, swill it around (without splashing) and then rinse with water. Pour in some solution B to clear the brown stain and then wash the vessel thoroughly.

Calcium deposits, such as in a processing unit incorporating a waterbath, can be removed by soaking or brushing with a weak (3 to 5 per cent) solution of nitric acid, subsequently rinsed. Photographic stains on clothing or hand towels can sometimes be removed by soaking in unused ammonium thiosulphate fixer to which citric acid (15 g per litre) has been added. Test for colour fastness first.

There is a great temptation to use powerful household cleaners such as bleach to remove stubborn stains from dishes but this is not advisable since any traces may contaminate processes in the future.

Ray Duns

Conversion tables—metric to English/American

Volume

Milli-litres	UK fl oz	US fl oz	Litres	UK gallons	US gallons
1	0.0352	0.034	1	0.22	0.264
2	0.0704	0.068	2	0.44	0.528
3	0.106	0.101	3	0.66	0.793
4	0.141	0.135	4	0.88	1.06
5	0.176	0.169	5	1.10	1.32
6	0.211	0.203	6	1.32	1.59
7	0.246	0.237	7	1.54	1.85
8	0.282	0.271	8	1.76	2.11
9	0.317	0.304	9	1.98	2.38
10	0.352	0.338	10	2.20	2.64
25	0.881	0.845	25	5.50	6.60
50	1.76	1.69	50	11.0	13.2
75	2.64	2.54	75	16.5	19.8
100	3.52	3.38	100	22.0	26.4
250	8.80	8.45			
500	17.6	16.9			
750	26.4	25.4			
1000	35.2	33.8			

Mass

Grams	Grains	Ounces	Kilo-grams	Pounds
1	15.4	0.035	1	2.20
2	30.9	0.071	2	4.41
3	46.3	0.106	3	6.61
4	61.7	0.141	4	8.82
5	77.2	0.176	5	11.0
6	92.6	0.212	6	13.2
7	108	0.247	7	15.4
8	123	0.282	8	17.6
9	139	0.317	9	19.8
10	154	0.353	10	22.0
25	386	0.882		
50	772	1.76		
75	1157	2.65		
250	1543	3.53		
750	7716	17.6		
1000	15432	35.4		

Linear measure (Metric to English)

Millimetres	Inches
1	0.039
2	0.079
3	0.118
4	0.157
5	0.197
6	0.236
7	0.276
8	0.315
9	0.354
10	0.394

Centimetres	Inches
1	0.394
2	0.787
3	1.18
4	1.57
5	1.97
6	2.36
7	2.76
8	3.15
9	3.54
10	3.94
11	4.33
12	4.72
13	5.12
14	5.51
15	5.91
16	6.30
17	6.69
18	7.09
19	7.48
20	7.87
25	9.84
30	11.8
40	15.7
50	19.7
60	23.6
70	27.6
80	31.5
90	35.4
100	39.4

Metres	Feet
1/4	0.820
1/2	1.64
3/8	2.46
1	3.28
2	6.56
3	9.84
4	13.1
5	16.4
6	19.7
7	23.0
8	26.2
9	29.5
10	32.8

Area measure

Square centimetres	Square inches	Square metres	Square feet
1	0.155	1	10.76
2	0.310	2	21.53
3	0.465	3	32.29
4	0.620	4	43.06
5	0.775	5	53.82
6	0.930	6	64.58
7	1.09	7	75.35
8	1.24	8	86.11
9	1.40	9	96.88
10	1.55	10	107.6

Temperature

°C	°F	°C	°F	°C	°F	°C	°F	°C	°F
0	32.0	21	69.8	42	69.8	63	115.4	84	183.2
1	33.8	22	71.6	43	109.4	64	147.2	85	185.0
2	35.6	23	73.4	44	111.2	65	149.0	86	186.8
3	37.4	24	75.2	45	113.0	66	150.8	87	188.6
4	39.2	25	77.0	46	114.8	67	152.6	88	190.4
5	41.0	26	78.8	47	116.6	68	154.4	89	192.2
6	42.8	27	80.6	48	118.4	69	156.2	90	194.0
7	44.6	28	82.4	49	120.2	70	158.0	91	195.8
8	46.4	29	84.2	50	122.0	71	159.8	92	197.6
9	48.2	30	86.0	51	123.8	72	161.6	93	199.4
10	50.0	31	87.8	52	125.6	73	163.4	94	201.2
11	51.8	32	89.6	53	127.4	74	165.2	95	203.0
12	53.6	33	91.4	54	129.2	75	167.0	96	204.8
13	55.4	34	93.2	55	131.0	76	168.8	97	206.6
14	57.2	35	95.0	56	132.8	77	170.6	98	208.4
15	59.0	36	96.8	57	134.6	78	172.4	99	210.2
16	60.8	37	98.6	58	136.4	79	174.2	100	212.0
17	62.6	38	100.4	59	138.2	80	176.0		
18	64.4	39	102.2	60	140.0	81	177.8		
19	66.2	40	104.0	61	141.8	82	179.0		
20	68.0	41	105.8	62	143.6	83	181.4		

Conversion factors

inches–cm	2.54	cm–inches	0.3937
feet–m	0.3048	m–feet	3.2808
UK fluid oz–ml	28.41	ml–UK fluid oz	0.0352
US fluid oz–ml	29.57	ml–US fluid oz	0.0338
UK gallons–l	4.546	l–UK gallons	0.22
grains–g	0.0648	g–grains	15.432
ounces–g	28.35	g–ounces	0.0353
pounds–kg	0.4536	kg–pounds	2.2047

Agfa Gevaert

Agfacontour is a special film material which enables you to produce, contour-like images from continuous tone or line originals relatively simply

Print contrast control At the very start of black and white print making, you can control the way tones are reproduced in the negative and influence picture mood

Simple toning Colour dyes and simple chemical mixes can be used to tone the metallic image of a black and white print into, commonly, sepia, blue or copper hues. With care you can even apply tones selectively to a small area of the print, though this is more difficult

Combination prints use image components from at least two different negatives (or slides) which are printed on to the same sheet of paper. The same effects can be achieved by multiple exposure but you have more control

Tone elimination This technique turns the continuous tones of a colour or b & w original into black or white. Lith film is used to produce working size 'negatives', the start of many other derivations

Printing control techniques can be introduced during the first stages of enlarging to correct or alter sharpness, distortion dodging, masking and diffusion

Solarization is the common (inaccurate) name of the Sabattier Effect technique which distorts tones and colours of film or paper which is re-exposed part way through development

Henry/Explorer

Printing on unusual materials For something different you can print on presensitized aluminium plate, fabric, plastic or even coloured b & w paper

Simple montage The components from several different prints can be combined to form realistic or bizarre montages using cut-and-paste or more sophisticated mounting methods

Paper negative Quaint images and considerable localized tone control can be obtained using this technique in b & w printing or, as a novelty, in colour printing

Texture screens Home-made or commercial effect negatives, tissue and cloth can all be used in sandwich with a negative or slide to give a textured appearance to the image

Elizabeth Welsh/Tony Stone Picture Library

Bas relief, a very simple technique using slightly out-of-register copy images in sandwich with the original to produce a tone-suppressed three-dimensional relief

Photo drawings An ordinary b & w photograph can be reduced to the form of a drawing simply by overtracing in waterproof ink before bleaching away the image

Photograms Shadow effects can be obtained by placing solid, transparent or translucent objects on a sheet of b & w or colour print paper or film

Combinations in colour By refining the techniques of masking—perhaps by using a home-made masking jig—combination prints in colour are also possible

Advanced toning Special kits such as those by Pebeo, Tenenal and Colorvir offer a limitless range of colour effects, some not unlike solarization

B & W posterization By using tone separation negatives on lith film to build up distinct tone bands in an image, poster-like effects are possible from B & W or colour originals

Special effects printing A single image can be printed more than once to create multiple image prints for amusement and unusual abstracts

B & W reversal processing Good, powerful images can look especially effective in black & white—particularly in the form of a slide with its long tonal range

Back-to-front processing Unusual effects can be obtained by processing colour slide film as a negative or, for that matter, a negative film in a reversal process

Handcolouring At a simple level you can add touches of colour to highlight a detail—or take handcolouring to true art form to achieve results impossible by conventional colour photography

James Wedge
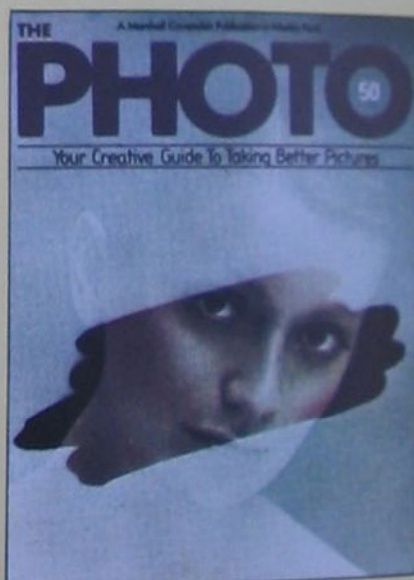
Using colour print film In place of ordinary colour printing paper, try using colour print film to make large transparencies for display or for your portfolio

Color-Key Thin sheets of sensitive film, used like lith but exposed by UV light, which is available in a wide range of colours to enable quick posterization effects by simple overlays

Creative photocopying Large-size continuous tone or lith separation negatives can be used with various types of copier to produce unique images in b & w or colour

Colour from b & w By using an ordinary b & w original in place of a colour negative, and suitable filtration, subtle or intense coloured positives can be produced

Etch–bleach Turn high contrast negative b & w print (or film images) into colourful positives using a simple bleaching and colour dyeing reversal process

Advanced printing processes

Carol Christopher

Contrast control masks is a sophisticated method of producing colour and tone corrected copies from 'difficult' negatives and slides which do not print well otherwise

Making calotypes This is one of the loveliest and most easily duplicated old time processes. The results are unusual and the process is fairly inexpensive

Photo silkscreen One of the real craft techniques whereby a photographic original can be converted for use in screen printing, enabling any number of printings on to paper, card or fabric

Gum dichromate is a way of making colourful and highly textured art-like prints from large-size high contrast negatives. In this process you coat the paper of your choice using special coloured emulsion

Airbrushing In the hands of a skillful operator, an airbrush can introduce very subtle effects. Its uses also include retouching blemishes and adding non-photographic details. It is a technique widely used in commercial work

Tone-line can be used for both colour and b & w to produce line drawings photographically—which can also be combined with the original for key-line effects

Colour posterization Using tone and colour separation negatives and drop masks, together or separately, for printing different colours, to distort colour

Controlled solarization is a method of standardizing the re-exposure routine required for solarization so that the results can be predicted

Colour separations form the basis of all three-colour (additive) printing methods and require care in production if accurate colour reproduction is required

Photo-etching A lith or high contrast original can be transferred on to copper or zinc plate which is then etched and used for printing ink images
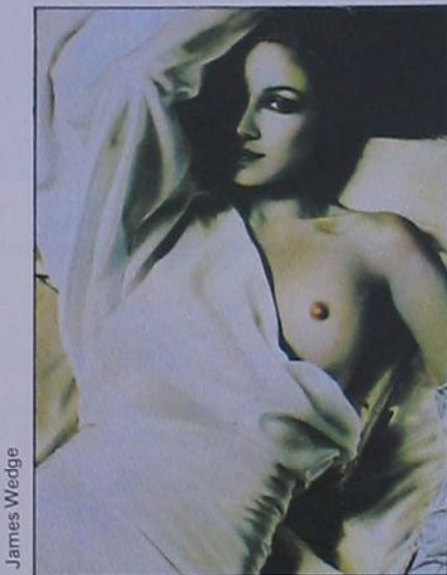
James Wedge

Colour masking By using contrast control masks (or masks produced employing the same techniques), tones and specific colours can be distorted

Dye transfer is an expensive and time-consuming technique for perfect and long lasting colour prints. You start by making a set of colour separations

Halftone screening You can use a scaled down method of photomechanical reproduction to produce ready-screened images for use in low cost publications

Geoff Winkley

Carbro prints This technique is cheaper than dye transfer and offers many of its advantages. This pigment process also requires a set of perfect colour separations

Platinum printing is to b & w printing what dye transfer is to colour. It uses the most expensive of ingredients, and requires considerable care in preparation

Bromoil is an old-time process which has no modern day counterpart. Its remarkable ability to combine sharpness with texture permits some wonderful pictorial work

Old processes You can get grass-roots experience of photography's early beginnings by duplicating many of the early experiments in producing sensitive material

Darkroom safety

The close proximity of water and electricity is a major hazard even in a temporary darkroom—perhaps moreso than in a properly designed permanent set-up. 'Dry' work areas—where you would expect to keep and use the majority of darkroom electrical items—must be kept that way, and physically separate from the 'wet' work area. Do not conduct any of the 'wet' operations, such as print processing and washing anywhere within reach of an electrical switch or appliance unless this is designed for use in conjunction with processing. If you have to work in a confined space where there is some risk of breaking this rule, consider fitting a circuit breaker socket to the mains socket you are using. Other safety aspects: Do not use paraffin or gas heaters—and bar type heaters only if they are wall-mounted. Wires should not trail across the floor or any 'wet' work bench. Make sure any pipework and sink arrangement is well clear of the electrical mains supply and power points and switches. Shelving has to be especially well supported. Keep food and drink away from chemicals.

Peter Western

DATA

Equipment essentials

Most manufacturers publish specifications and data for their ranges of cameras, lenses and films. Knowing and understanding these can help you to choose the right film and equipment to suit your needs

The vast range of cameras, lenses and accessories on the market can make selecting and buying equipment extremely confusing unless you know exactly what you are looking for. Most of the advertisements in photography magazines give specifications for the various products on the market, but unless you are familiar with some of the terms used in these advertisements then you could find them confusing,. A glossary of some of the terms used in these advertisements could therefore be useful in helping you to find the right equipment.

'Acute matte' screen A coarse-surface focusing screen which gives a bright image, but loss of detail for fine focusing (see page 1828).

Auto-exposure check (flash) A small indicator which lights up after a test shot to show that there is enough light.

Bright-line viewfinder Non-reflex camera viewfinders are often marked with a bright-line frame, etched into one of the elements (see page 1802).

Dedicated flash Designed for specific cameras, dedicated flashguns set the camera to sync speed automatically and make 'flash charged' and other information visible in the viewfinder.

Ergonomic design This is a system of design which allows for comfortable handling and more efficient opperation.

Exposure memory device This lets you

Tilt angle *Most flashguns now feature this. Some models also allow the flashhead to swivel horizontally*

take a reading from a subject, re-compose, and then shoot at the 'remembered' exposure.

Guide number A measure of the power of a flashgun, usually quoted for 100 ASA film (see page 228).

Infrared focusing A particular type of autofocus system (see page 643).

Internal focus A system of lens mechanics in which all focusing is done within the lens. This makes the lens less vulnerable to damage from dust and grit.

LED metering A type of viewfinder display in which small lights, usually red and green, give metering information.

Macro focusing zoom Some zoom lenses feature macro facility for close-up work. Strictly speaking, however, these are not genuine macro lenses (see page 60).

'Magic needle' loading A special design of take-up spool for quick and simple loading.

Match needle metering In this system a needle is centred at the side of the viewfinder to give correct exposure.

MTF (modulation transfer function) A method of testing lens performance (see page 1100).

One touch zoom A zoom lens in which a single collar serves as a zoom and a focusing control (see page 60).

Programmed mode Automatic exposure in which the camera selects both the aperture and the shutter speed (see page 203).

All pictures Roger Payling

Magic needle *Loading film into a camera can be fiddly. This system, however, makes loading quick and simple*

Characteristic curves

for a range of popular films

Most film manufacturers publish data sheets for their products and these usually include the characteristic curve for the particular film. Knowing the characteristic curve can provide you with useful information about the contrast, speed and exposure latitude for a particular film (see page 1518). For colour films it will also show you the reponse of the three emulsion layers.

The graphs on the right show the curves for a selelction of popular black and white, colour slide and colour negative films. Although not intended as a comparison, it is interesting to see the variety of curves.

Different manufacturers publish different information with their graphs. With Ilford B/W films, for instance, two curves are given—one for normal contrast and one for high contrast development. Curves for different development times are also given for Kodak Recording film and High Speed Infrared.

Kodachrome 64
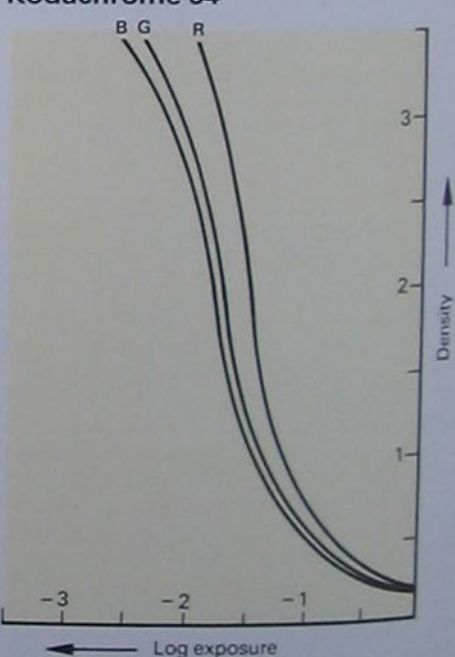
Kodachrome 64 *Colour slide films have a steep curve and therefore high contrast compared to colour negative film. Notice also how the three curves separate at the shoulder of the curve, indicating that there is a slight colour cast in the shadow areas*

Pulse button exposure control Some cameras feature this in place of a shutter speed dial. The shutter speed is set by pressing a button until the correct value is reached.

QF (quick focus) system This incorporates a viewfinder display which lights up when the chosen subject is in focus.

Short travel focal plane shutter This refers to a vertical plane shutter as opposed to a horizontal (see page 84).

Slave unit (flash) A small remote device which triggers an off-camera flash in response to the main flash.

Stop down preview A button which allows the lens to be stopped down to its working aperture, making it possible to check depth of field.

Three way focusing screen A focusing screen with a central split image screen surrounded by a ring of microprisms, set into a ground-glass screen.

Thyristor circuitry This is found in many flashguns and saves unused power.

Tilt angle (flash) This refers to the bounce facility of some flashguns. The flash head can be tilted to the angle of bounce you need (see page 101).

Tri colour exposure guides This is a series of three lights in the viewfinder display. One colour shows underexposure, another shows overexposure and the third shows correct exposure.

Kodachrome 25 (daylight)	Ektachrome 64 (daylight)	Ektachrome 200 (daylight)	Ektachrome 160 (tungsten)	Agfachrome 100 pro
Agfachrome CT18	Agfachrome CT21	Kodacolor II	Agfacolor 80 S	Agfacolor CNS
Agfacolor CNS400	Panatomic-X	Plus-X pan	Tri-X pan	High speed infrared
Kodak recording film	Ilford Pan F	Ilford FP4	Ilford HP5	Ilford XP1
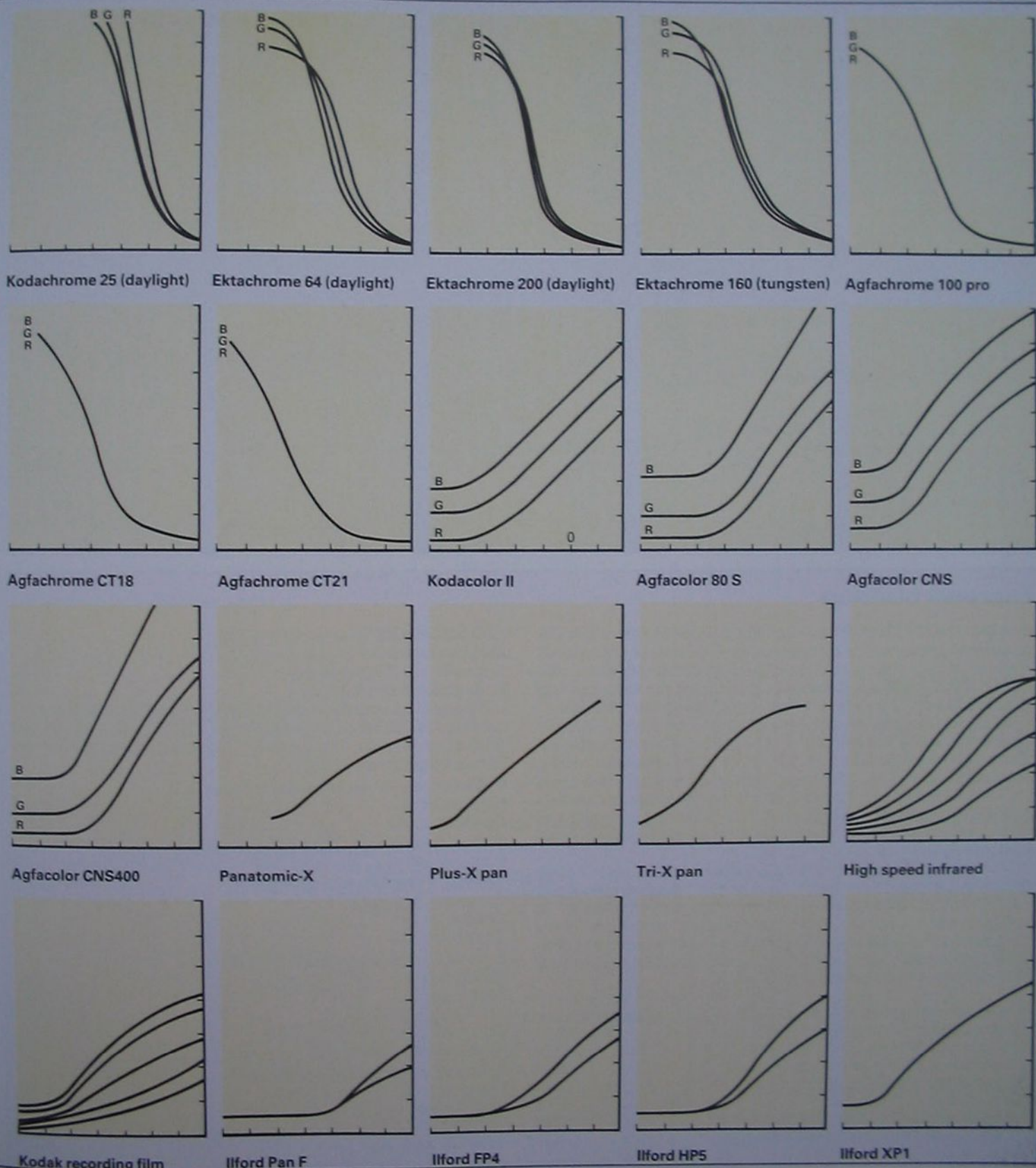
Battery types and codes

Batteries for photographic use come in a variety of shapes, sizes and types (see page 1363). Each has its specific use either in camera meters, flash or motor drive units and generally the instructions with these products specify which battery you should use.

It is important to get the right battery as a wrong choice may cause damage to equipment. Because there is no standard coding system for batteries, a battery from one manufacturer may have an entirely different name from a similar battery made by another manufacturer. Some of these are shown in the table on the right.

Battery code	Voltage V	Type	Capacity mAh	Other names
D357 (10L14)	1·5	Silver oxide	130	SR44, B-SR44H, HRW42, 303, SR44W/G13W, WL14, RW42, 357
PX625	1·35	Mercury	250	MR9, H-D, RPX825, V625PX
DL1/3N	3	Lithium	160	CR1/3N
PX23	5·6	Mercury	100	4NR42, HR33, RPX23, EPX33, V23PX
PX27	5·6	Mercury	150	4NR43, RPX27, EPX27, V27PX
PX28L	6	Lithium	160	544, V28PXL
7H34	5·6	Mercury	175	537, V4034PX
7K67	6	Alkaline	400	539, 4018
7R31	4	Mercury	225	KR31, HR31, 538
MN1500	1·5	Alkaline	1800	HP7, 242, MN1500, K6, LR6, AM3, LR6, 815, AM3, E91, 4006, KLR6

Roger Payling

Edgeprint markings

At some time or another you may find you need to refer back to a particular negative or transparency in your collection. If you have an index then you will have recorded the name and type of film used to take a particular shot, but if not then you can identify the film by looking at the markings on the top edge.

Most films are easily identifiable as manufacturers generally stamp the name and type of film at regular intervals along the top edge of the strip of film. However, some manufacturers' films are less easily identified—the most notable of these are Kodak's which use a numbered coding system for identification. Each film is classified by a number stamped on to the top edge of the film, generally at about 50 mm intervals.

The table below gives the edgeprint codes for most Kodak films, and if you use Kodak films a lot then these codes could be useful for identification. They could also be useful in actually compiling an index of negatives or slides for future reference. For instance, if you are familiar with the codes then 6017 may be simpler to write in an index than the more lengthy Ektachrome 64 professional (daylight).

1 Kodak transparency films, 135 size — edgeprint code

Ektachrome 64 Professional (daylight)*	5017
Ektachrome 64 Amateur (daylight)	5031
Ektachrome 200 Professional (daylight)*	5036
Ektachrome 200 Amateur (daylight)	5076
Ektachrome 200 (daylight)*	5074
Ektachrome 50 Professional (tungsten)*	5018
Ektachrome 160 Professional (tungsten)*	5037

Ektachrome 160 Amateur (tungsten)	5077
Ektachrome slide duplicating film	5071
Kodachrome 25 (daylight)	5073
Kodachrome 64 (daylight)	5032

(* These films are also available in 120 size. The codes are the same as for 135 size except that six replaces five as the first digit of each code. For example, Ektachrome 64 Professional has an edge code of 6017).

2 Kodak colour negative films, 135 size

Kodacolor II	5035
Kodacolor 400	5075

3 Kodak colour negative films, 120 size

Vericolor II Type S	6010
Vericolor II (commercial) Type S	6019
Vericolor II Type L	6013
Kodacolor II	6014
Kodacolor 400	6075

4 Kodak black and white film, 135 size

Panatomic-X	5060
Plus-X Pan	5062
Tri-X Pan	5063
Recording film	2475
High speed infrared	2481

5 Kodak black and white film, 120 size

Panatomic-X	6040
Plus-X Pan	6057
Tri-X Pan	6043
Royal-X Pan	6046

Paper sizes

Sheet sizes inch	cm			Roll sizes—length usually (10 m) 33 ft or (30 m) 98½ ft	
3½ × 5½	8·9 × 14	8¼ × 11²/₃	21 × 29·7 (A4)	inch	cm
5 × 7	12·7 × 17·8	9½ × 11¾	24 × 30·5	20	50·8
6½ × 8½	16·5 × 21·6	10 × 10	25·4 × 25·4	30	76·2
7 × 9½	17·8 × 24	11¾ × 16	30·5 × 40·6	41	106·7
8 × 10	20·3 × 25·4	16 × 20	40·6 × 50·8	55	142·0
		20 × 24	50·8 × 61		

Format and focal length

Of all camera formats 35 mm is perhaps the most versatile for taking a range of different lenses. Some of the larger formats also take a range of lenses, although usually there is nothing like the versatility available with 35 mm.

The focal length of the 'standard' lens for any format is equal to the diagonal of the format. Consequently, the smaller the format the smaller the focal length of the 'standard' lens. Similarly, any additional lens will also vary from format to format, as can be seen from the table. Although most of these values are purely theoretical, it is interesting to see how other formats relate to the popular 35 mm format.

Format	Dimensions in mm	Diagonal (standard focal length in mm)
Disc	10 × 8	14
110	17 × 24	22
35mm	36 × 24	43
6 × 4.5 cm	60 × 45	75
6 × 6 cm	60 × 60	85
6 × 7 cm	60 × 70	92
6 × 9 cm	60 × 90	108
5 × 4 inch	127 × 102	163
10 × 8 inch	254 × 203	325

| Format	Equivalent Focal lengths in mm											
35 mm	7	16	24	35	43	50	85	105	135	200	300	500
Disc	2	5.2	8	11	14	16	28	34	44	65	98	163
110	4	8	12	18	22	26	44	54	69	102	154	256
6 × 4.5 cm	12	28	42	61	75	87	149	183	236	349	524	872
6 × 6 cm	14	32	47	69	85	99	168	207	267	395	593	989
6 × 7 cm	15	34	51	75	92	107	182	224	289	428	642	1070
6 × 9 cm	18	40	60	88	108	125	214	264	339	502	754	1256
5 × 4 inch	27	61	91	133	163	189	323	398	512	758	1138	1896
10 × 8 inch	53	121	181	264	325	377	644	793	1021	1511	2269	3780

Spectral sensitivity curves

Spectral sensitivity curves for colour films differ from characteristic curves in that they show the sensitivity of each of the three emulsion layers to each wavelength of light in the spectrum. Characteristic curves, on the other hand, only show the response of each of the layers to the total light (see page 1970).

For an ideal colour film each of the three layers would be evenly sensitive to exactly a third of the spectrum. The graph for such a film would consist of three rectangular blocks of equal height and width.

Unfortunately, such a film does not exist and in practice there is an overlap between the three layers. This means, for instance, that the magenta, green sensitive layer is sensitive to a certain amount of blue and red light as well as to green light.

The graphs on the right show the spectral sensitivity of four typical colour films and it is interesting to see how each film appears to have a greater response to one colour than to another. Kodacolor II, for instance, has a perceptibly greater sensitivity to blue light than to green and red light.
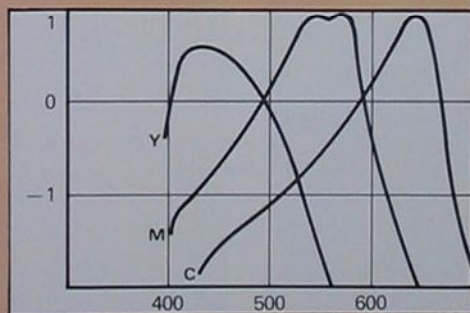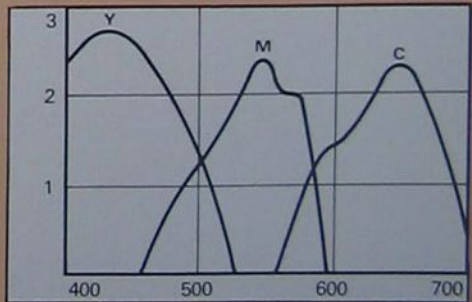
Ektachrome 200 (daylight)
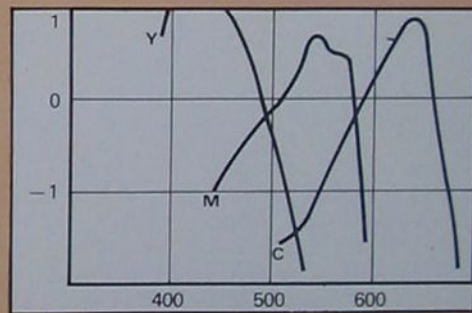
Kodacolor II

Agfachrome CT18

Agfacolor CNS

Chris Lyon

2695

The creative approach

The essence of creative photography is hard to pin down, but for images to be both interesting and appealing, the importance of basics such as lighting, composition and viewpoint should never be overlooked

Lisl Dennis/The Image Bank

The one aspect of photography which is virtually impossible to teach is creativity. Yet apart from the lucky shot, creativity is what makes some pictures really succeed. Technical excellence goes only so far—the elusive element of creativity is usually vital.

But what is a creative photograph? Is it some strangely artistic picture, with no obvious subject, which leaves many of its viewers wondering what it is about? Or is it more recognizable but with a gimmick that makes it different from every one else's photograph of the same subject? Both these approaches are creative, yet creativity extends a great deal further. Creativity implies originality—a new way of treating the subject—so clearly it is a development of the most straightforward approach. The photographer's aim is always to take a small piece of the world and to capture it, but the creative approach means capturing it in a way that is particularly interesting and appealing.

Creative Approach articles have looked at a wide range of different subjects, probing new ways of showing them in a photograph. But when faced with a subject, you need an instant solution to the problem of photographing

it creatively and if possible in a style which is uniquely your own. So it is worthwhile exploring the ways in which creativity can be achieved.

Composition

There is no one ideal composition for a picture. When framing the picture your personal style reveals itself without any conscious effort. Given the same subject and lens, there are dozens of different ways of forming the composition, and you will choose the one that looks best to you, though it might not suit someone else. Nevertheless, there are a number of basic pointers to good composition.

The problem with creative composition lies in deciding on the boundaries between the obvious, the unorthodox and the bizarre. It is nice to avoid the obvious and the clichéd, but how do you achieve a result that is different, yet not so outrageous as to be unacceptable to the viewer? There is a danger, with all approaches, in believing that unusual equals creative. Ideally, therefore, you should explore the limits of composition while bearing in mind the classic rules, so that you are fully aware when you break them. To some people this comes intuitively, but others need guidelines.
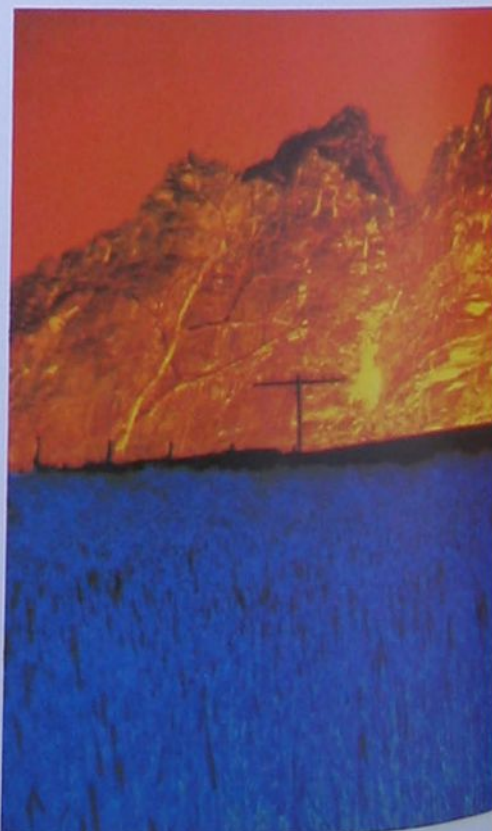
Some people maintain that for good composition you should establish a focus of attention in the picture, and make sure that it is clear what the picture is about. One way to do this is to keep the composition as simple as possible, framing out all distractions or cropping tightly. This is excellent advice, and is often a touchstone for good composition.

Another approach, however, is more daring: make the shot more complex, so that it repays careful study. This is a much more difficult technique, and does not work with every subject. There are many pictures which simply fall apart, with conflicting elements—though even this may be deliberate. Some of the world's top photographers work in this way, and you may have to educate your eye to appreciate their pictures at all, let alone develop your own work along similar lines.

The essence of composition is to make the whole picture more than simply the sum of its parts, so that it conveys an idea, emotion or feeling in a two dimensional photographic image.

Choice of viewpoint

As with composition, there is a narrow borderline between a creative view-

Golf ball *Low viewpoint, a wide angle lens and careful planning to align the sun directly behind the golf ball, produced a striking photograph— one that is novel without relying on gimmicks.* **Young couple** *A special effect need not be simply a lens attachment—here the photographer used a flashgun outdoors with a slow shutter speed to hold the colour of the sky. But it is the choice of subject and the general treatment, rather than the use of special effects, that make shots like this work.* **Blue wheat** *Mitchell Funk is well known for his use of filters, multiple exposures and other 'tricks' but he is careful to ensure that the subject is interesting in itself and complements the technique.* **Trees** *Pointing a wide angle lens upwards emphasizes the towering grace of this tree lined avenue—but the viewpoint is crucial*
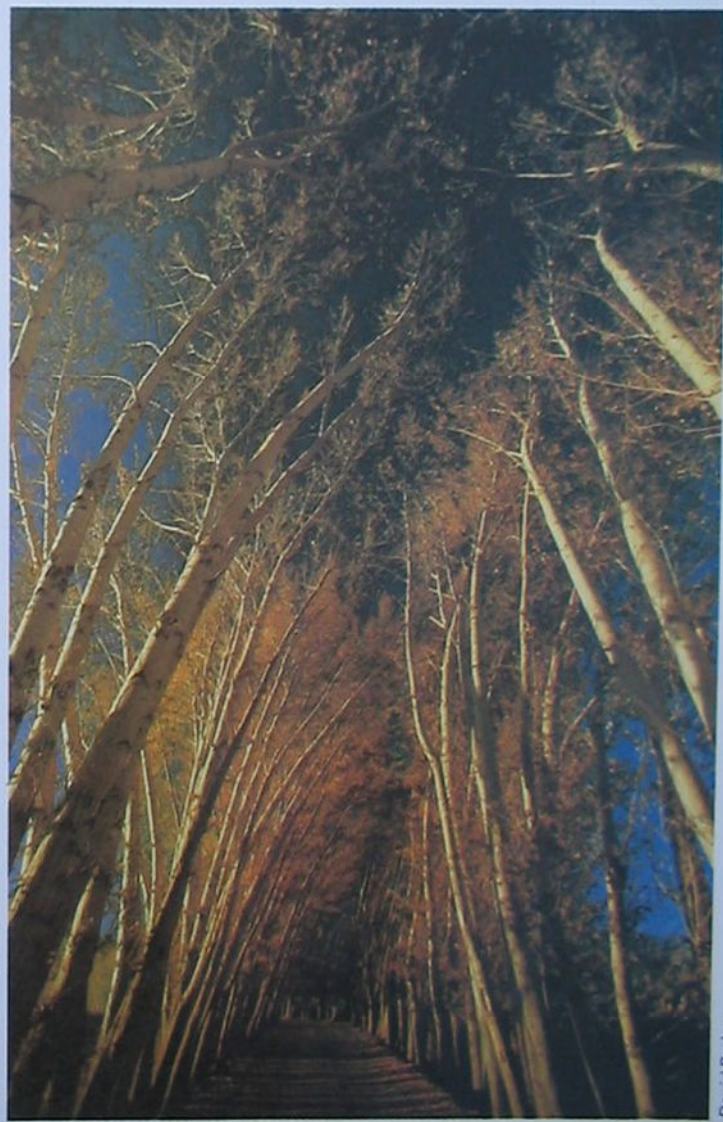
Creative approach

point and one that is just plain odd. There is every reason to explore and experiment with viewpoint, and there is a certain skill in spotting the viewpoint that is unusual yet still complements the subject. However, the whole idea of exploring viewpoints brings to mind the caricature of a creative photographer crawling on the ground, lying down or climbing lampposts in a futile endeavour to be different, ending up with a collection of strange shots which can spuriously be labelled 'art'.

The skill lies not in climbing the lamppost, but in visualizing the result before you bother, and deciding just how

typical lens selection for general purpose photography would be a 24 or 28 mm, a 55 mm macro, and a 200 mm. Each of these lenses has its own characteristic way of viewing the world, different from the much despised 50 mm standard lens. Many good photographers never use a standard lens, other than for close-up work.

This is odd in some ways, because the 50 mm lens gives a view which is closest to that of the eye. Any picture taken with a standard lens, presumably, is therefore merely a record, a faithful but boring copy of reality. But there is no reason why creative shots should not be

Painted boat *By closing in on the bold colours, a strong, graphic image was created, enhanced by the low viewpoint.*
Railway siding *The desolate feel of this location was emphasized by framing the buildings low down in the picture area, thus giving prominence to the open sky and the attractive clouds*

Vautier/de Nanxe

Lisl Dennis/The Image Bank

Javan schoolchildren *Where the background contributes little, close in on the subject for a strong, simple image*

the picture will look. If you shoot at random from all sorts of odd viewpoints, you might just get a good picture, but the technique is rather similar to that of artists who produce abstracts by riding bikes over the canvas. On the other hand, since beauty is in the eye of the beholder, you might just find that both you and your audience appreciate your approach. There can be no fixed rules about what is good and what is bad—it all depends on what people want at any particular time.

If your choice of viewpoint is inspired by your imagination, however, there is a greater chance that you will be able to develop the approach into your own personal style of photography.

Choice of lens
Composition, viewpoint and lens choice often go together, but it is evident that many photographers regard certain lenses as 'creative' to the almost total exclusion of others. In particular, a

Denis Waugh

Surfer Backlighting and the use of a long lens creates a bold silhouette contrasted with the glistering surf

taken using standard lenses as much as using the all-seeing wide angle or the prying telephoto.

Nevertheless, the non-standard focal lengths are very popular for some forms of creative photography—pictorial work especially, though less so for documentary and reportage, for which moderate wide angles are favoured. The more extreme wide angles, though they have a field of view about as wide as the eye, compress this into the frame so that we see everything at once—they are good for showing the relationship between different elements in a scene by bringing them closer together, giving an original view of the world. Imagine for example, a brown ploughed field and a blue sky—the wide angle will tend to reduce these to blocks of colour, whereas a standard or telephoto lens will show details of the field which could distract the eye.

On the other hand, the telephoto tends to allow you to pick out individual details

Alan Porter

in the scene, emphasizing them. Your photographer's eye must work in a different way when seeing telephoto pictures—you must often make more decisions about what to leave in and what to cut out, which is where much of the creativity of using such lenses lies.

Lighting
Very many good photographs of otherwise ordinary subjects are interesting simply because the lighting was right. There are many possibilities—hard and contrasty for punchy shots, soft for romantic or nostalgic pictures, or backlit shots. The lighting must complement the subject, so if you have any control over it you can emphasize any particular feature you want. Even in the case of a landscape you can choose the lighting by waiting or even returning some other time, or simply by moving around so that the light comes from another direction.

In many cases you have to use your imagination to show you how a particular shot could look if only the lighting was different. Even in the case of a still life, where all the lighting is controllable, it helps to have some idea of what you want to achieve—and this is best done by picturing an effect in your mind, then working out how to achieve it.

Lighting can sometimes be altered to suit your personal taste. Some movie directors are well known for their characteristic lighting, but still photographers, too, have their own approach to the use of light. This does not mean, however, that you always take pictures at sunset or you always use moody lighting

Glider *Choice of lighting is crucial in creative photography—here light alone made the shot full of atmosphere*

when taking a portrait. It can be as subtle as careful use of shadow to show form, or a tendency to prefer warm lighting. But take care not to use your favourite trick at every opportunity—you will simply end up with a set of similar looking pictures.

Technical tricks
A good many photographers rely on technical means to achieve creative results. This approach can range from using grainy film, through effects filters to montage or combination printing. In fact every photograph is a technical trick of some kind—you are using a technical medium, and as Marshall McLuhan put it, 'the medium is the message'. In other words, by taking a photograph of something rather than writing a poem or embroidering a tapestry you are approaching it from a certain point of view. By representing motion by giving a slow shutter speed and allowing the subject to blur you are using a simple photographic trick which is the opposite end of the spectrum from fisheye lenses and multiple image filters.

This is probably the most versatile way of introducing creativity, but at the same time it is definitely the least highly regarded. This is probably because anyone can put a prism over their lens and call it art, but only in a small proportion of such cases does the prism really add anything worthwhile. Often this is because the effects produced are

so unsubtle that the photograph is more a picture of the effects than of the subject. The secret is to previsualize each shot with a particular effect, to explore in your mind which effect, if any, will complement the picture. That way you will save time and film, and also become used to looking at the world in terms of the effects so that when a genuine opportunity to use one arises, you will be able to choose the right one.

Imagination
The most important ability that the creative photographer can have is imagination. You should be able to see what the picture will look like before you even raise the camera. In this way, you can decide how to make changes which will influence the mood and emotional content of the shot, using all the aspects of creativity at your disposal.

Imagination is a faculty that can be developed by practice as much as all your technical skills. And there is more to it than simply seeing a picture in your mind's eye—you should be able to 'think laterally' and come up with original approaches. Some people find this much easier than others, inevitably, otherwise everyone would be a brilliant photographer.

You may not achieve the same success rate as an expert and acknowledged photographer, but by constantly striving for creativity your work should show worthwhile results. Set yourself challenges, and above all take pictures. In photography, as in so many other fields, practice makes perfect.

JUDGING PICTURES OF PEOPLE

Every photographer is tempted to take candid shots of people from time to time. But, as our judges found with this selection, simply catching your subject unawares is not enough to make a good picture

A

B

C

D

E

The Photographers' Choice:

Colin Molyneux	**D A E B C**
Ian McKinnell	**D E A C B**
Homer Sykes	**C E D B A**
John Sims	**C D B E A**

None of the members of the panel were impressed by these photographs of people, taken as a group. Each, however, had a favourite and this led to an interesting comparison of analyses.

There was a clear division of opinion over the choice for first place, with Homer Sykes and John Sims putting C first while both Ian McKinnel and Colin Molyneux were unimpressed by C and instead chose D. Homer Sykes said of C 'the photographer has produced a picture that very clearly tells a story. The

mountains, the very tired father and the well-worn walking boots all go to say one thing. A little bit of humour has been added, with the larger-than-life feet being the first thing to grab your attention.' John Sims also liked what he called 'the wry sense of humour'.

It is clear that the gentle approach of C which impressed Sykes and Sims merely seemed dull to Molyneux and McKinnell who put C last and second last respectively. Instead they liked the 'dynamic feel' of D, McKinnell complimenting 'the restlessness imparted by the shape the man makes and also through the other elements— the diagonal yellow lines and the thrusting shape of the parking sign'. They also both drew attention to the

paradoxical impact of the photograph, with the policeman's pose and other elements giving a feeling of energy while the floppy cat dissipates the tension with its lazy relaxation.

'People' pictures can clearly be approached from different angles. What seems gentle and harmonious to one photographer can be labelled 'lacking in dynamism' by another. Our panel spontaneously split up into two pairs, each judging by different criteria.

Whatever their criteria, however, all our judges tacitly agreed on two things— photos A, B and E were all too uninteresting to be worth commenting on, and technical shortcomings— particularly underexposure—still wasted potential.